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CONTENTS

THE EFECT OF PHYSICAL ACTIVITY ON BLOOD AND INTRAOCULAR PRESSURES IN PATIENTS WITH GLAUCOMA

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Summary: The aim of the study was to evaluate the effect of aerobic exercise on blood (BP) and intraocular pressure (IOP). A group of six female patients, mean age 54 + 3,4 years, with pharmacologically treated open angle glaucoma were enrolled in 3-months aerobic exercise program (formed by aerobics and fit ball exercises) with frequency of sessions 2-times per week. The values of intraocular pressure varied before intervention in the normal range. After the program IOP was reduced more, with exception of one slight increase, but the value does not exceed the standard. There were no differences in blood pressure between input and output values. No significant pressure variation during the day, neither hypotension was found out. In patients with borderline low blood pressure a slight increase in systolic and diastolic pressure was recorded after the intervention. Regarding the impact of acute exercise on blood pressure the unambiguous assessment cannot be done. However, in some cases the pressure was increased immediately after the exercise, and a reduction in systolic and diastolic pressure was recorded as well. The results of our study suggest a positive impact of aerobic program on retention the risk factors of glaucoma under the control.

Key words: patients with glaucoma, intraocular pressure, exercise program, aerobic load

Introduction

From the pathophysiological aspect, glaucoma is a group of illnesses that are often (but not always) accompanied by an increased intraocular pressure (IOP) caused by a worse intraocular liquid outflow and glaucoma damage, i.e. a loss of retina neural cells and optic nerve fibers resulting in visual field defects.

One of the factors leading to the glaucoma damage is a worsened perfusion caused mainly by vascular deregulation.

The importance of systemic blood and intraocular pressure in glaucoma

Strict control of risk factors is a prerequisite for development and prevention of loss of nerve fibers. One risk factor is elevated intraocular pressure. Since perfusion pressure is influenced by intraocular and systemic blood pressure, association of high IOP with low blood pressure is very unfavorable. For low blood pressure is considered the value below 100/60.

The very low blood pressure has similar effects as elevated intraocular pressure in case the damaged self-regulation (the ability of tissues to adapt their current needs congestion independently of perfusion pressure). In patients with glaucoma the self-regulation is often damaged.

Mechanism of low blood pressure effect

- Low blood pressure itself causes ischemia, which leads to death of ganglion and glial cells.
- When reperfusion occurs, free radicals are formed, which further increases the degree of damage. Free radicals inhibit the glutamate absorption by astrocytoma. Glutamate in elevated concentrations inhibits toxic effect.

Glaucoma patients are also more prone to fluctuations of systemic and IOP, which acts negatively (Edelson, 2002). Severe may be a night pressure drop. IOP is the result of a balance between production and outflow of intraocular fluid. In glaucoma the increase in IOP is caused by deterioration of the drainage of intraocular fluid. Value of normal intraocular pressure is very difficult to be determined. Most people have an average IOP 9 – 21 tor. However, glaucoma damage may also occur with IOP less than 21 tor, on the other hand, it does not occur at levels higher than 21 tor. The threshold beyond which the damage occurs is very individual and depends also on other risk factors.

Control of these two risk factors – elevated IOP and decreased blood pressure means their management by medicaments and other means. Very often the IOP lowering medicaments or the laser and surgical treatment are used. An important factor leading to reduction in IOP and the means of treatment of too low blood pressure may also be a regular aerobic exercise as physical activity improves cardiac function, increases blood flow in the eye and thus positively affects ocular nerves nutrition.

Physical activity and IOP

Distelhorst (2003) states that on the base of the results of studies from their workplace regular physical activity helps to reduce IOP and everything that lowers IOP reduces pressure on the optic nerve and thus the possibility of its damage. The highest reduction is caused by activities which involved large muscle groups.

According to Goldberg (1981) there is a reduction in IOP during exercise, possibly through induced acidosis and increased plasma osmolarity. According to Guttmann et al (2002) aerobic exercise reduces IOP, which protects retinal cells, improves blood flow to the retina and optic nerve. According to several authors, the results of previous studies revealed no medicamentous means beneficial to glaucoma patients in terms of improving blood flow to the retina or with a significant protective effect on nerve cells in the retina, so the best way to rescue nerve cells remains aerobic activity.

The research conducted by Passo (1991) shows that after the 3-month aerobic training mean IOP decreased by 20%. After training cycle the IOP values returned to baseline values in 3 weeks period. The results of research impact cycling (4-times, 40 minutes each) showed that in patients who regularly practiced exercises for 3 months, IOP was reduced by 20%. In continuation of physical activity at least 3 times a week the beneficial effect was maintained. If the training was interrupted for more than two weeks, the effect on IOP reduction was lost.

It is well known that high blood pressure presents a health risk, and that physical activity (especially aerobics) has a positive effect in the treatment of hypertension. However, it should be noted, that no matter how high blood pressure is important in the pathogenesis of other diseases in glaucoma is different. The low blood pressure values mean health risk for developing glaucoma damage. Aerobic physical activity has a positive impact also in the treatment of low blood pressure (Flammer, 2003). However, effect of chronically elevated blood pressure is not negligible, as leads to atherosclerosis, which generally has an adverse effect on the eye and may affect the further course of glaucoma.

Regular aerobic training combined with the reduction of elevated IOP, increase of low blood pressure and improved perfusion can be an effective nonpharmacological agent for patients with glaucoma. In patients with drug therapy the physical activity can be an effective complement of treatment.

Contribute to knowledge on the role of physical activity in the treatment of glaucoma we tried:

- Detect acute changes in blood pressure after single exercise unit.
- Detect the effect of 3-month aerobic training on intraocular pressure values.
- Detect the effect of 3-month aerobic training on systolic and diastolic blood pressure.

Methods

Intraocular pressure was measured 2times before and 2times after 3-month exercise program in eye clinic. Blood pressure was measured within 1 week, 5 times a day before and just after the program. In addition, blood pressure was determined before and after each single exercise units.

Design of the study

Six women were included in the study, average age 54 ± 3.4 years with diagnosis of open angle glaucoma, treated with local drug therapy. None of the patients had a diagnosis of glaucoma with pigment dispersion in which the exercise would be contraindicated.

Subjects underwent a 3-months exercise program, with a frequency of 2 times per week and duration 55 to 60 minutes per session. The aerobic dance and fit ball aerobic exercises were alternated. Each session was structured as follows:

1. Warm up (10 – 15 minutes) - low impact aerobics, pre-stretching.

2. The main part of the aerobic training (20 – 30 minutes) – continuous, alternating load. Average heart rate ranged from 50 to 85 % HR_{max}

3. The final part (5 – 7 minutes) – static stretching exercises designed for total relaxation.

Results and discussion

The intraocular pressure as one of the major risk factors for glaucoma varied before the intervention in the normal range. After the program a reduction was still found out in IOP except one case where there was a slight increase, but the value does not exceed the normal values (Fig. 1).

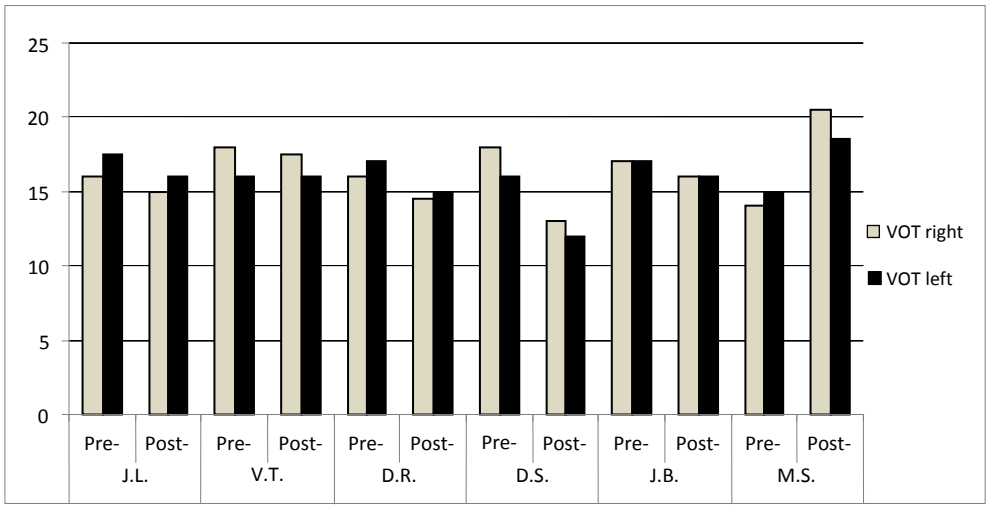

Figure 1

Pre- and post- exercise IOP values [tor].

Blood pressure after the 3 – month intervention was virtually no different from initial values. (Fig. 2 – 6).

We have found out no significant pressure fluctuation during the day, which is considered one of the serious unfavorable factors.

The hypotension was not found in the study group, i. e. a decrease in blood pressure below 100 tor systolic and 60 tor diastolic. In patients with borderline low pressure the slight increase in exercise systolic and diastolic pressure was found after completing the exercise program. (Fig. 2, 3).

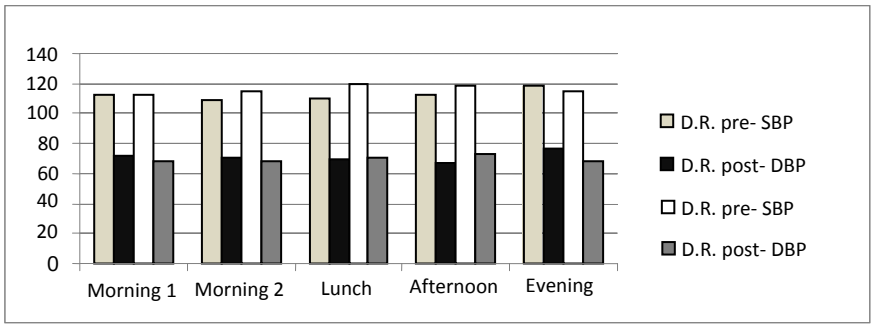

Figure 2

Changes of systolic and diastolic BP values [tor] after completing the aerobic program in D. R.

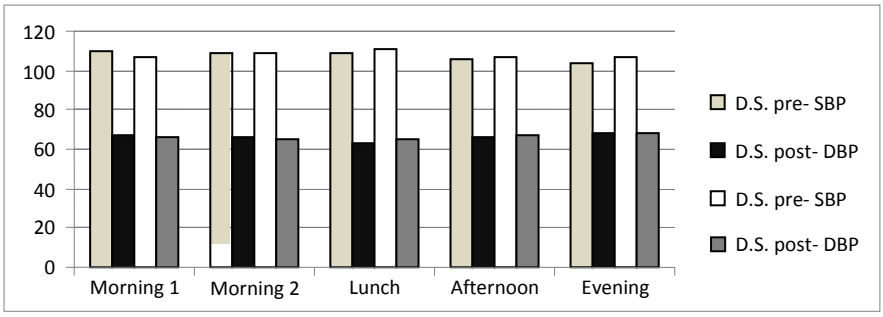

Figure 3

Changes of systolic and diastolic BP values [tor] after completing the aerobic program in D. S.

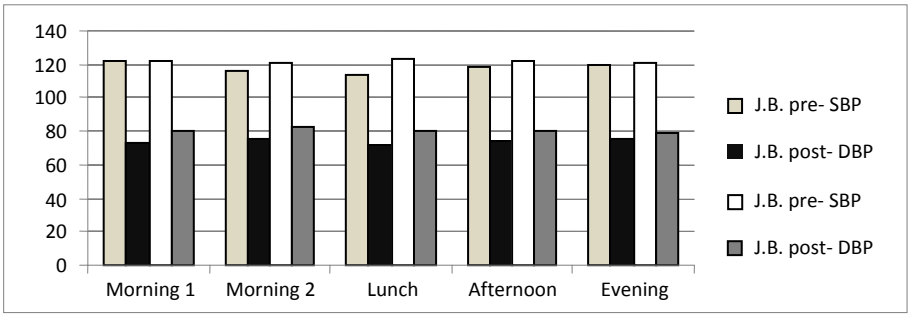

Figure 4

Changes of systolic and diastolic BP values [tor] after completing the aerobic program in J. B.

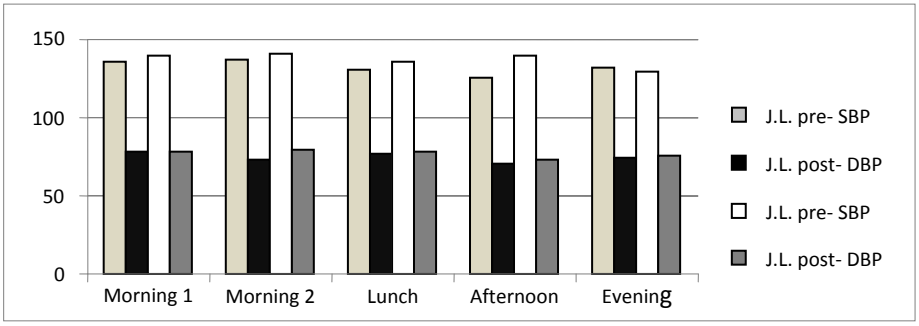

Figure 5

Changes of systolic and diastolic BP values [tor] after completing the aerobic program in J. L.

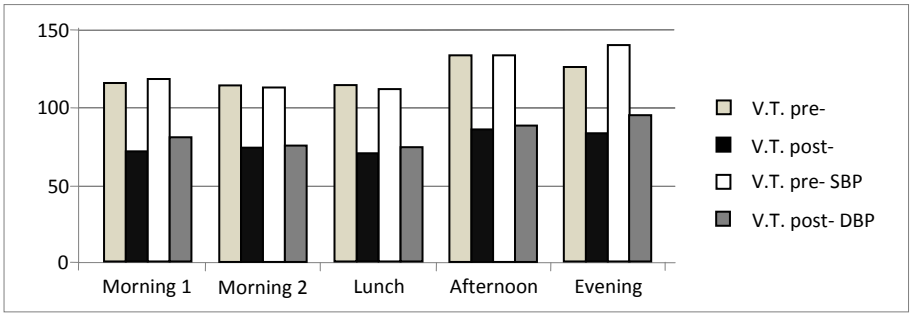

Figure 6

Regarding the impact of acute exercise unit on blood pressure values, there is not possible to give an unambiguous assessment. In some patients immediately after exercise BP was increased, but we recorded also a reduction in systolic and diastolic pressure. Changes, however, ranged only between 5 – 15 %.

The IOP values decrease can be considered very important, because of reduction of pressure on the optic nerve and thus the decreasing of possibility of its damage. Our findings about impact of physical activity on IOP are in accordance with the studies of Goldberg (1981) and Guttmann (2002). Also the slight increase in systolic and diastolic pressure in patients with borderline low pressure can be found beneficial.

Although BP and IOP values did not exceed normal limits, finding the border values of low blood pressure in some patients may be a stimulus for more detailed monitoring and managing to avoid adverse combination of low blood and high intraocular pressure.

Conclusion

We realize that due to low number of subjects in our study, generally valid conclusions cannot be pronounced. It can be stated that the results of our research indicate a positive impact of aerobic program in keeping the risk factors of glaucoma under control.

In patients with glaucoma quality of life may not differ from that of healthy people and visual function can be preserved. However, it must be strict adherence to the regimen, including physical activity. Especially aerobic activity should be a part of the lifestyle of this patients group, as it can positively influence individual risk factors, including intraocular and blood pressure.

References

1. Distelhorst, J. S., Hughes, G. M. 2003. Open-angle glaucoma. American Family Physician 67(9), 2003, p. 1937 – 1944.
2. Edelson E. et al. 2002: IOP fluctuations – subjects of recent glaucoma research. Ophtalmol – Times, Vol. 27/233, 2002, pp. 6 – 7.
3. Flammer, J. et al. 2002. The impact of acular blood flow in glaucoma. Progress in Retinal & Eye Research, July, Vol. 21, 2002, 4, pp. 359 – 394.
4. Flammer, J. 2003: Glaukom. Triton : Praha, 2003. 417 s.

5. Goldberg, I., Hollows, F. C., Kass, M. A., Becker, B. 1981. Systemic factors in patients with low-tension glaucoma. Br. J. Ophtalmol, 1981, 65, pp. 56 – 62.
6. Gutmann, Ch. 2002. Ophtalmology Times 1/1/27, 2002, 1, p. 4.
7. Passo, M. S. 1991. Exercise training reduces intraocular pressure among subjects suspected of having glaucoma.JAMA, October 23/30, Vol. 266, 1991, No 16, p. 2210.
8. Shapiro, A., Wolf, E., Ferber, I., Merin, S. 1983. The effect of physical activity on the intraocular pressure of glaucomatous patients. European Journal of Applied Physiology and Occupational Physiology, Volume 52, 1983, Number 1, p. 136 – 138.
9. WILLIAMS, P. T. 2009. Relationship of Incident Glaucoma versus Physical Activity and Fitness in Male Runners. Medicine & Science in Sports & Exercise, August, 2009, Volume. 41, 8, pp. 1566 – 1572

RESUMÉ

VPLYV POHYBOVEJ AKTIVITY NA KRVNÝ A VNÚTROOČNÝ TLAK PACIENTOV S GLAUKÓMOM

Janka Lipková – Oľga Kyselovičová

Z patofyziologického hľadiska je glaukóm ochorením, ktoré býva často avšak nie vždy sprevádzané zvýšeným vnútroočným tlakom spôsobeným zhoršením odtoku a tzv. glaukómovým poškodením – stratou nervových buniek sietnice a vláken optického nervu, čo vyústi do defektov zorného poľa. Cieľom tejto štúdie bolo overiť vplyv aeróbnych cvičení na vnútroočný (VOT) a krvný tlak (TK). Výskumný súbor tvorilo 6 žien priemerného veku 54 ± 5,3 rokov, s farmakologickou liečbou glaukómu s otvoreným uhlom. Aeróbny program trval 3 mesiace s frekvenciou 2x týždenne. Hodnoty vnútroočného tlaku ako jedného z hlavných rizikových faktorov glaukómu sa pohybovali pred začatím intervencie v normálnych hraniciach. Po skončení programu došlo k redukcii VOT, okrem jedného prípadu, kde došlo k miernemu zvýšeniu, avšak hodnoty nepresiahli normálne rozmedzie. Rozdiely medzi vstupnými a výstupnými hodnotami TK boli minimálne. Nezistili sme ani významné kolísanie tlaku počas dňa, ktoré je považované za nepriaznivý faktor. U žiadnej z pacientiek nebola zistená hypotenzia, avšak u probandiek s hranične nízkym tlakom, došlo vplyvom cvičenia k miernemu zvýšeniu systolického i diastolického tlaku. Čo sa týka akútneho vplyvu cvičení na krvný tlak, u niektorých pacientiek došlo k zvýšeniu, avšak zaznamenali sme aj zníženie systolického i diastolického tlaku, v rozmedzí 5 – 15 %. Hoci hodnoty vnútroočného a krvného tlaku nepresahovali normálne hodnoty, predsa len nález hranične nízkeho tlaku u niektorých pacientiek môže byť stimulom pre detailnejšie monitorovanie a ovplyvňovanie, aby bolo možné vyhnúť sa nepriaznivej kombinácii vysokého VOT a nízkeho TK. Kvôli nízkemu počtu probandiek nie je možné vysloviť všeobecnejšie závery, avšak výsledky naznačujú pozitívny vplyv aeróbneho tréningu v smere udržania rizikových faktorov glaukómu pod kontrolou.

EVALUATION OF MOVEMENT COMPETENCES BY MEANS OF SURFACE ELECTROMYOGRAPHY

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Summary: The goal of our contribution is to demonstrate a way of evaluation of stability of individual experiments by means of surface electromyography. We are demonstrating three cases of the possibility to exploit the correlative analysis, coefficient of determination, linear regretion and coefficient of variation in evaluation of the stability in performing the competences. A measure of stability of experiments at one closed competence – overthrowing and two cyclic competences – open ones has been documented. The results show us possibilities of exploitation of electromyography for evaluation of both types of competences.

Key words: Surface Electromyography, overthrowing, swimming, and skiing

Introduction

During the period of motoric learning the origin of creating the motoric learning is the code and it is characterized by the pupil's ability to repeat the movenet without some greater differences in the outer performance. Most of the methods based on the performance of the movement evaluating also the origin on observing method (Süss, 2006), most often by means of evaluating the critical of the outer performance points (Knudson &. Morisson, 1997). Thus we gain relatively positive picture about the outer performance, but the question is, whether there was a creating and fixation of the neuromuscular connections needed for the movement competence. One of the methods how to measure the involvement of the muscles during the actual movement is the surface electromyography (SEMG).

The goal of the electomyography signal is the transmembrane stream at the level of sarcolemy. We are speaking about the electric equivalent of the iont exchange at the membrane during the muscle contraction. The recording is called electromyogramme. It is usually more or less an imitation of the expressed interference of summarized pattern which originates by overcovering of the summarized potentials of greater number of motoric units. Here we are not speaking about a simple summarization of electric tension at the given moment, but the result should be the summarization of interferences in the space leading connector – he muscle, skin, electrodes (Rodová, Mayer & Janura, 2001). The value individual parametres of the electomyographyc signal is influenced not only by physiological factors (a number of detected activated motoric unites, the type and average of muscle

threads, the depth and place of active muscle threads inside the muscle, the amount of the tissue between the electrodes and the active motoric units, stability of the income and the speed of burning etc,). However the influence of the factors of the methodic process of detection is of a great importance as well as the elaboration of the signal (De Luca, 1993).

The determination of the position of the electrodes and the reliability of measuring of the EMG signal are the subject of observations of e. g. Nagata, Yamada, & Magatani (2005), who indicate by means of a haphazard chosen combinations show a method how to elect the a right combination of placing at the forearm for measuring the measurement of the movements of the hand, which they then use for the prove of the measurement of the model – the robot of the hand (Wakita, Takizawa, Nagata, & Magatani, 2009). Sella do with the relationships of agonists and antagonists in the elbow using the correlation analysis SMEG of the selected muscles (Sella, 2003). The general goals of kineziological EMG are the analysis of the function of the coordination of muscles in different movements and the position of the body both in healthy and disabled volunteers during their training, both in humans and animals under the laboratory conditions as well as in their daily and expert activities. This research has been carried out by means of combination of EMG and kineziologigal or biomechanic methods of activities of methods of measurement (Clarys & Cabri, 1993). The method of observation of muscle activities by means of SEMG has its place in the evaluation of the momentum and speed of the start and relative balance of the muscle activities. In observing the complexity of movements' patterns. The eligibility of this method is recognized for the kineziology of the analysis of the human movement including walking and position (posture) (Rodová, Mayer & Janura, 2001), evaluation of the start of the muscle tiredness (Pánek, Pavlů & Čemusová, 2009), analysis of sport competences (Kračmar, Bačáková & Hojka, 2010; Pavelka, Satrapová & Kračmar, 2010; Kračmar, Bačáková, Hojka & Vystrčilová, 2010). As a diagnostic instrument for neurological disturbances the SEMG is judge in connection with the evaluation of e. g. patients suffering from neuromuscular disease of the lower back and the disturbance of motoric movements (Pullman, Goodin, Marquinez, Tabbal & Rubin, 2000).

The aim of this contribution is to show the possibilities of exploiting the SEMG for the evaluation of stability (variability) of the providing of the movement capabilities.

Methodology of research

We are speaking of the description based on three cases which were done during the term of several researches. We observed the involvement of muscles in chosen competences.

Observed set of cases

The following cases indicate:

1. A softball female player, 30 years old who was a member of the national representative team of the Czech Rebublic and she also played the first league in the Czech Republic. With her we observed the overhead throwing.

2. A former skier in Alpine disciplines, 35 years old.

3. A disabled swimmer, group L2, 31 years old man, overknee amputation.

All these persons are volunteers in the research programme and they do agree with the anonymous publication of their results.

Methods

Electromyografhic recording

The basic method of finding the activation of muscle groups is the surface electro-myography (SEMG). We did measured by SEMG at chosen muscle groups that are described in individual cases. As an instrument we used the portable measuring facility working on the basis of EMG potentials carried on the body of the proband, the total weight is 1,3 kilogram and the pattern frequency is 200 patterns per second, filters frequency is 30 – 1200 Hz. This frequency is relevant for researches of large muscle groups, of big and fast moves (Merletti & Parker, 2006). The recording of the inner memory of the instrument was after having finished the series of measurements transferred to a portable PC and adjusted by a special programme KAZE5 and exported to the programme Microsoft Excel. A more detailed data about the facility and exact placing of the electrodes (Travell & Simons, 1999) are at disposal with the authors.

Time analysis

Based on the defined beginning and end of the analysed units (determination of critical points) (Knudson & Morisson, 1997; Matošková, Süss & Zahálka, 2008), we have done a rough guess of the length of duration of individual steps by means of the time analysis of the video recording. The 25 Hz frequency of the video sequence is sufficient for define critical features in the move of body segments (Knudson & Morisson, 1997).

Synchronization of EMG recording with video recording

Because of the differences in video recording (25Hz) and EMG recording (200Hz) it was necessary to synchronize the beginnings of the unites of analysis in EMG measurements. After having established the comparable unit (experiment) we have established the synchronized beginning of the unit of analysis by means of autocorrelation (Konrad, 2009). Based on a selection of the highest possible correlation between the result of the comparable unit and the selected unit of analysis we have established the beginning of the EMG recording.

Normalization of data

As the units of analysis were of different time, it was necessary to normalize the data by means of transfer to the percentual time axis (Konrad, 2009). The transfer of units to percents was done by means of establishing the average of the data in the interval corresponding one percent in each analysed unit of the analysis. Thus we obtained the possibility to compare quantitavely the EMG recordings in each unit of the analysis.

Statistics analysis

When evaluating the stability of experiments in individual cases we have chosen the evaluation by means of: Correlative analysis, coeffient of determination, linear regression and a coefficient of variation (Hendl, 2004). All these above mentioned methods were used as a basis for the expert evaluation by means of effect of size.

Interpretation of results (casuistic)

Analysis of the overhead throwing

In the first case we concentrated on the competences on softball – overthrowing. The similarity of experiments will be shown by means of correlative analysis results of linear regression. The task of the player was repeatedly throwing the ball overhead as fast as her fellow player for the distance of 15 metres. The speed of the throwing was controlled by means of radar (radar STALKER ATS).

Fort the evaluation we chose 15 overhead throwing of the speed 88-90 $km.h^{-1}$. We observed the electric activity of 7 muscles (m.):

1 – m. tensor fasciae latae sin.,

2 – m. obliquus externus abdominis dx.,

3 – m. serratus anteror,

4 – m. pectoralis major dx.,

5 – m. biceps brachii dx.,

6 – m. deltoideus anterior dx.,

7 – m.gluteus maximus dx.

For the evaluation of the similarity of electric activity of chosen muscles in individual experiments was used the evaluation by means of Spearman correlation coefficient. The results of correlation between individual experiments in electric activity of the observed muscles and the coefficient resulting from the determination is shown at table 1.

Table 1

Correlation coefficients among individual experiments n = 15

	1. muscle	**2. muscle**	**3. muscle**	**4. muscle**	**5. muscle**	**6. muscle**	**7. muscle**
Coefficient of correlation							
Average	0,812	0,914	0,92	0,957	0,929	0,904	0,842
minimum	0,712	0,857	0,88	0,922	0,795	0,642	0,756
maximum	0,942	0,977	0,969	0,976	0,966	0,984	0,937
Coefficient of determination							
Average	0,66	0,84	0,85	0,92	0,86	0,82	0,71
minimum	0,51	0,73	0,77	0,85	0,63	0,41	0,57
maximum	0,89	0,95	0,94	0,95	0,93	0,97	0,88

Legend: *1 – m. tensor fasciae latae sin., 2 – m. obliquus externus abdominis dx., 3 – m. serratus anteror, 4 – m. pectoralis major dx., 5 – m. biceps brachii dx., 6 – m. deltoideus anterior dx., 7 – m. gluteus maximus dx.*

CD – coefficient of determination

Coefficients of determination actually determine show many results from results B may be guesse from results A. These results show a great stability of the work for at majority of chosen muscles the results reach more than 88 % of the level of our guess. The expetion are m. tensor fasciae latae sin (average correlation 0,812 a KD 0,66) and – m. gluteus maximus dx. (average correlation 0,842 a KD 0,71). However event with these muscles we can see high values. Another possible indicator of the similarity of experiments is the comparison of the electric activity of haphazard experiment with the avarage of all measurements. One of the possibilities of comparison is the linear regression Figure 1 shows linear regression of the third throw in comparison to the average of the above mentioned m. pectoralis major dx. The calculated coefficient of linear regression R = 0,944 shows a very important relationship between the results of the electric activity of the muscle in the fifth experiment with the average activity established out of 15 observed experiments.

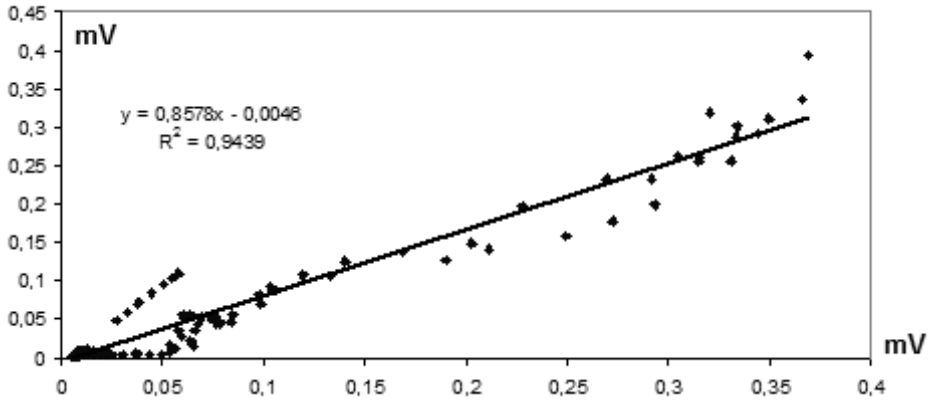


Figure 1

Linear regression at musculus pectoralis major dx.

Our second case is an example of specific locomotion – ski skating (double-pole push from one-step). The task of the female skier was to go keeping the same speed using bothsided one step skating. By means of the average of the normalized results we have established the average electric activity of the chosen muscles in the duration of one step. The first three steps were significantly different in its longitude (shorter time), because it was the skier's start and the initial impulse. We counted the average electric activity from her 5th to her 15th step of each run distance. The experiment was repeated five times. The results have been then calculated out of the total of 30 steps. Based on the synchronized video recording we have determined the individual steps so that one skiing step was defined from the take of right leg (the last snap-shot of the moment the ski contact snow) back to the same moment. In order to make the beginning of EMG signal precise we used the principal of autocorrelation. When judging the similarity of individual muscles involvements we came out of the average EMG graphs and just to make it easy we show only the standard graph of electric activity of m. peroneus longus dx. (Figure 2), where the curve in

the middle indicates the average and the upper and lower curves are pluses and minuses, the indicative is the difference from this average. The size of the indicative difference shows us in any and every measured moment the stabile duration of the involvement of m. peroneus longus dx. during the ski cross-country step. The size of the standard deviation generally shows the homogeneity of the obtained data, but the coefficient of variability is a more suitable indicator, which expresses the percentual size of the indicative difference to the average of the measurement. The average results of the variation coefficient at all observed muscles are shown at table 2. The results show low values of the variation coefficient except of m. vastus medialis dx. Which stabilize and causes the extension in the knee joint.

Table 2

Variation coefficient – skating

	Observed muscles	**Variation coefficient**			
	Muscle	Average	max	min	SD
1	m. gluteus maximus dx.	25,51	38,75	12,09	6,20
2	m. gluteus medialis dx.	18,36	39,63	7,94	7,45
3	m. adduktor longus dx.	22,09	43,61	4,95	8,10
4	m. vastus medialis dx.	75,90	180,40	31,12	42,25
5	m. peroneus longus dx.	18,20	45,11	9,84	6,15
6	m. tibialis anterior dx.	21,80	50,90	7,48	9,73
7	m. gastrocnemius dx.	27,75	82,10	12,90	12,60

At Figure 2 we are further showing the variation coefficient transferred to the time of the ski cross country runner steps in percents, as obtained from the standardized results. It is obvious that in the duration of the run the movement is very stabile which can be seen in the results of the variation coefficient up to 25 % except the time 42 % of duration of the step, where from the point of view of the performance we take in con sideration the moment in which the skier is still on the one leg base and is preparing for the take on of the leg to the snow). At this phase we can suppose a higher variability (m. vastus medialis dx.), because the skier must react to the ground she is moving on.

Our third case is an example of specific locomotion of handicapped swimming. In this case we focused on the symmetry of involvement of chosen muscles at a swimmer of group A2 as per IPC – SAEC/SW (International Paralympic Committee – Sport Assembly Executive Committee- Swimming). The results of our study show asymmetric involvement of the muscles during one swimming cycle, but from the point of vies of the experience swimmers it indicates a very stabile performance. As an example we have chosen an analysis of a free style swimming cycle. We are speaking about a 31-years old man whose left leg had to be amputated resulting from a disease at the age of 5 – over knee amputation. The results of the variation coefficient in table 3 show almost constant performance of individual swimming cycle.

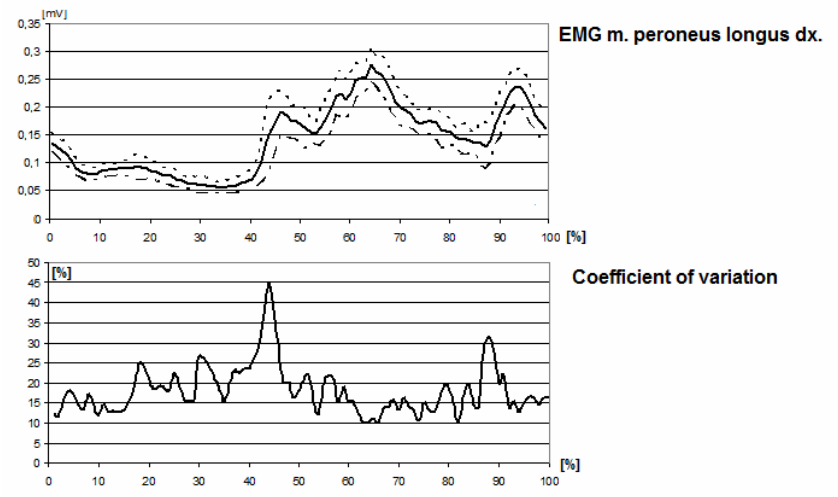


Figure 2

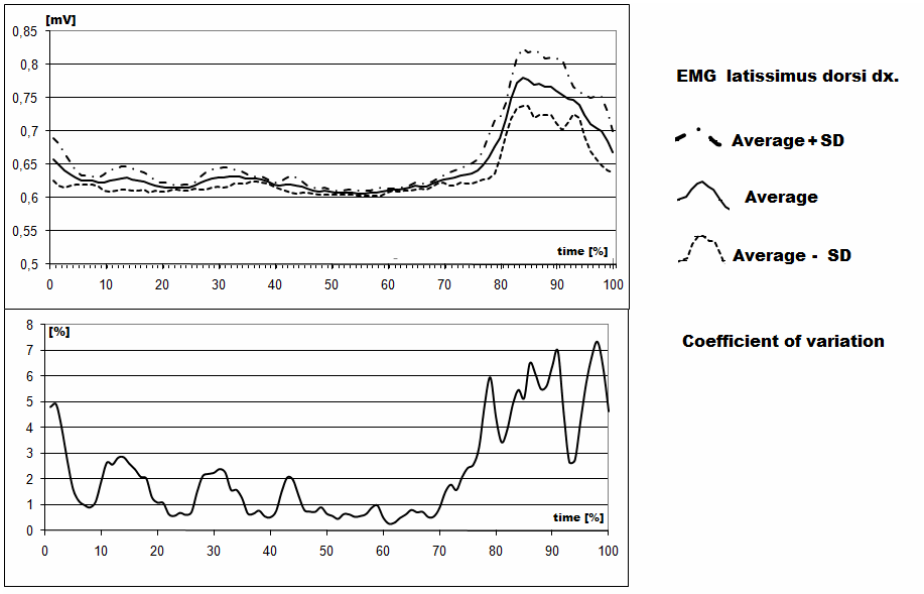
Skating

Table 3

Results of the variation coefficient in observed muscles – swimmer in free style

Muscle	**Variation coefficient [%]**			
	Average	max	min	SD
m. latissimus dorsi dx.	2,31	7,36	0,27	1,93
m. latissimus dorsi sin.	2,49	6,69	0,30	1,89
m. obliq.abd.ext. dx.	4,85	16,72	1,12	2,92
m. obliq. abd. ext. sin.	4,16	10,12	1,61	1,90
m. pectoralis maj. dx.	2,23	7,96	0,42	1,45
m. pectoralis maj. sin.	6,61	16,78	1,44	3,46

Just to illustrate we show at figure 3 the run of the electric activity of m. latissimus dorsi dx. And also the run of the variation coefficient at a standardized graph.



Conclusion

Surface electromyography (SEMG) in kineziology observes the muscle activation, coactivation of muscle groups in complex and selected movement (Kračmar, Süss, Machač & Matošková, 2008; Kračmar, Smolík & Bačáková, 2009; Mrůzková & Bačáková, 2010), impact of the burdening of the muscle function, it may observe the process of the therapeutic process (Kračmar, Bačáková & Herdová, 2010), as well as the effect of the movement burdening (Mrůzková, Bačáková & Hojka, 2009). As per our cases it is suitable to use our SEMG also as a method for comparing the stability of performance of the competences under standard conditions, the example of the analysis of overthrowing (closed competences), but it also helps in open and cyclic competences, as we can see with ski cross country skiing a free style swimming. EMG is not capable to safeguard the total work of the muscle, as in isolated observation method cannot give a relevant information about the performance, however it helps to order the given performance. EMG is contemporaly the only observing method that is able to give evidence about the coordinative part of the sport movement provided in the intentions of the individuality of each individual person. EMG may be used in the open air, outdoors unlike limited laboratory conditions it is observing the movement *in vivo*, for intraindividual comparison.

Acknowledgements

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References

1. CLARYS, J. P., CABRI, J. 1993. Electromyogrophy and the study of sports movements: a review *Journal of Sports Science vol.* 11 no 5, 1993.
2. DE LUCA, C. J. 1993. *Use of the surface EMG signal for performance evaluation of back muscles*. The International Society for Biomechanics, 1993.
3. HENDL, J. 2004. *Přehled statistickým metod zpracování dat*. Praha : Portál, 2004. ISBN 80-7178-820-1.
4. KNUDSON, D., MORRISON, G. 1997. *Qualitative Analysis of Human Movement.* Champaign III : Human Kinetics, 1997, p. 250. ISBN 0-88011-523-8.
5. KONRAD P. 2009. *The ABC of EMG* a *Practical Introduction to Kinesiological Electromyography* [cit. 2009-07-25] Retrieved from www: http://reseau.risc.cnrs.fr/fichiers/apercu.php?numero=1.
6. KRAČMAR, B., BAČÁKOVÁ, R., HOJKA, V. 2010. Vliv cyklistického kroku na pohybovou soustavu. *Rehabilitace a fyzikální lékařství,* vol. 17, 2010, no. 3, pp. 107-112.
7. KRAČMAR, B., BAČÁKOVÁ, R., HOJKA, V., VYSTRČILOVÁ, M. 2010. Míra podobnosti kineziologických obsahů cyklistického kroku a kroku volné bipedální chůze. *Česká kinantropologie.* 2010, vol. 14, no. 3.
8. KRAČMAR, B., BAČÁKOVÁ, R., SATRAPOVÁ, L., HERDOVÁ, D. 2010. Inclusion of pelvis girdle muscles, trunk and lower extremity muscles during nording walking. *Journal of Outdoor Activities.* 2010, 3(1), pp. 12-26.
9. KRAČMAR, B., SMOLÍK, P., BAČÁKOVÁ, R. 2009. Kineziologický obsah delfínového vlnění jako alternativní formy lidské lokomoce. *Rehabilitácia,* 2009, roč. 46., č. 1.
10. MATOŠKOVÁ, P., SÜSS, V. & ZAHÁLKA, F. 2008. The movement of a skier with one above-the-knee leg amputation in the course of a turn. *Acta Universitatis Carolinae Kinantropologika,* 2008, vol 45, no. 2, p. 81-92.
11. MERLETTI, R., PARKER, P. A. 2004. *Elektromyography, Physiology, Engineering, and Noninvasive Applications.* A John Wiley & Sons, INC., Publication, 2004.
12. MRŮZKOVÁ, M., BAČÁKOVÁ, R. 2010. Komparativní analýza přímého záběru vpřed na sjezdovém kajaku a v pádlovacím bazénu. In Gryc, T. *Věda v pohybu, pohyb ve vědě 2010*. Sborník příspěvků. Praha : UK FTVS, 2010, p. 102-106. ISBN 978-80-86317-76-2.
13. MRUZKOVA, M., BACAKOVA, R., HOJKA, V. 2009. Zapojení vybraných svalových skupin do lokomoce pletencem ramenním v různých kanoistických disciplinách. *Sborník vědecké konference Pohyb, výchova, zdraví 2009.* Ústí nad Labem : 2009.
14. NAGATA, K., YAMADA, M. & MAGATANI, K. 2005. Recognition method for forearm movement based on multichannel EMG using Monte Carlo method for channel selection", *Proceeding of the International Federation for Medical & Biological Engineering Vol.12* 2005."
15. PÁNEK D., PAVLŮ, D., ČEMUSOVÁ, J. 2009. Rychlost vedení akčního potenciálu svalu jako identifikátor nástupu svalové únavy v povrchové elektromyografii *Rehabilitace a fyzikální lékařství* vol. 16, No. 3, 2009, pp. 96-101.
16. PAVELKA, R., SATRAPOVÁ, L., KRAČMAR, B. 2010. Kineziologická analýza modifikací kliku jako posilovacího cvičení a využití ve fyzioterapii. *Rehabilitace a fyzikální lékařství*, vol. 17, 2010, no. 3, pp. 129-133.
17. PULLMAN, S. L., GOODIN, D. S., MARQUINEZ, A. I., TABBAL, S., & RUBIN, M. 2000. Clinical utility of surface EMG Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 2000; 55:171-177.
18. RODOVÁ, D., MAYER, M. & JANURA, M. 2001. Současné možnosti využití povrchové elektromyografie. *Rehabilitace a fyzikální lékařství.* 2001, no. 4, p. 173-177.

19. SELLA, E. G. 2003. Elbow Muscular Relationships: An SEMG View of Muscular Agonism & Antagonism. *The Journal of Neurological and Orthopaedic Medicine and Surgery* Vol 21, No. 3, 2003.
20. SÜSS, V. 2006. *Význam indikátorů herního výkonu pro řízení tréninkového procesu.* Vědecká monografie. Praha : Karolinum 2006. 173 p. ISBN 80-246-1162-7
21. TRAVELL, J. G., SIMONS, D. G. 1999. *Myofascial Pain and Dysfunction: the triggerpiont manual*. Vol. 1. Baltimore : Williams & Wilkins. 1999.
22. WAKITA, Y., TAKIZAWA, N., NAGATA, K., & MAGATANI, K. 2009. Development of the Equipment control Interface using Forearm SEMG. *Proceedings of 13th International Conference on Biomedical Engineering* Volume 23, Track 3, 2009.

RESUMÉ

EVALUACE POHYBOVÝCH DOVEDNOSTÍ POMOCÍ POVRCHOVÉ ELEKTROMYOGRAFIE

Vladimír Süss

Cílem příspěvku je ukázat na způsob hodnocení stability jednotlivých pokusů pomocí povrchové elektromyografie. Na třech kasuistikách ukazujeme možnosti využití korelační analýzy, koeficientu determinace, lineární regrese a koeficientu variace pro hodnocení stability provádění dovedností. Byla dokumentována míra stability pokusů u jedné zavřené dovednosti – hod jednoruč vrchním obloukem a dvou dovedností cyklických – otevřených. Výsledky ukazují na možnosti využití elektromyografie pro hodnocení obou typů dovedností.

THE ACUTE EFFECTS OF STRETCHING ON EXPLOSIVE POWER

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Summary: The purpose of the present study was to investigate the acute effects of performing two different stretching protocols on subsequent performance of vertical jumps. 24 subjects randomly performed two jumps with (CMJ) and without counter movement (SJ) before and after different types of stretching protocols. The height of the jump was calculated by the time of flight. We found that dynamic stretching was superior to static stretching for improving the height of the jumps. The use of dynamic stretching performed prior to vertical jumps can result in improvements in performance in certain subjects, the gains were 6,3 % in SJ ($p < 0,05$) and 6,9 % in CMJ ($p < 0,01$) higher from values before warm up. When the session of static stretching was used on the first place the decreasing of the jumps height was observed. SJ height decreased after static stretching (SS) from values before warm up by 2,81 % (p = n.s.) and for CMJ by 4,58 % ($p \leq 0,05$). Practitioners should demonstrate caution as subsequent vertical jump performance in certain subjects can actually be hindered by the use of prior static stretching and facilitated by the use of prior dynamic stretching.

Keywords: flexibility, stretching, elasticity, range of movement, training, vertical jump.

Introduction

Muscular strength is one of the most important factors in performing the vertical jump. If stretching has the acute effect of reducing performance in strength, it would be expected to reduce that of jumping as well. In practice, this information is highly important for sporting events in which strength and jumping performance are fundamental, since a decrease in performance may hinder the final result.

It is possible that conflicting results could be explained by the different methods used for stretching or by the absence of information regarding reliability and precision of these methods. Therefore, it is clear that this subject deserves further investigation. In addition, studies investigating the chronic effect of stretching on jump performance are also required.

Although clinicians are now generally aware of the issues related to stretching and injury, any authors also recommend stretching to improve performance (Stamford, 1984; Beaulieu, 1981). If stretching decreases muscle stiffness (via changes in passive visco-elastic properties), less energy is required to move the limb, and force/speed of contraction may be increased. But it depends on type of stretching. Alternatively, decreased stiffness may decrease storage of recoil energy, which would lead to greater energy requirements. If performance is enhanced, the issue of increased risk of injury may be moot for some

persons. If stretching increases compliance, it is possible that the muscles' length-tension curve is shifted. This might lead to changes in MVC when the muscle is in a short position but not when tested in a position of tension (i. e., still on the plateau of the length-tension curve). Some studies examined the acute effects of stretching on force, torque, and jump height. They illustrate the effects of an acute bout of stretching for MVC, jump height, and isokinetic torque, respectively. There were no studies that suggested that stretching is beneficial for these aspects of performance. An about 20 studies that found that an acute stretching session diminished performance (McNeal & Sands, 2001; Handel et al., 1997) One of these studies found static stretching detrimental for jumping, whereas dynamic stretching had no effect.

In order to understand the viscoelastic alterations resulting from stretching, the same group of authors, in three different studies, used ultrasound to observe the medial gastrocnemius tendon and aponeurosis before and after stretching. (Kubo et al., 2001) concluded that 10 minutes of static stretching decreased the viscosity of the tendinous structures and increased their elasticity. In a chronic study, the same group combined resistance exercises with static stretching exercise were performed for 45 seconds with 15-second intervals, two sessions a day, 7 days a week for 8 weeks. In a third study (Kubo et al., 2002), the subjects performed static stretching in 20 consecutive days, with two sessions a day of five stretching exercises, lasting for 45 seconds, with 15 seconds of rest between exercises. The authors concluded from the latter two studies that training decreased the viscosity of the tendinous structures, but did not alter elasticity. Still trying to understand muscle elasticity, (Edman and Tsuchiya, 1996) concluded that during stretching exercises the most affected elastic structure was the titin, and that compliance properties of tendons and all the other elastic structures were less than for this protein. This concurs with other studies that have shown titin to be the main structure responsible for muscular elasticity (Minajeva et al., 2001; Tskhovrebova and Trinick, 2001). Further investigating this question, (Avela et al., 1999) hypothesis that the increase in compliance caused by stretching would be responsible for the decrease in the response caused by muscle spindles and, subsequently, a lower activity of α motoneurons (Rubini and Gomes, 2004) provide a review of the role of titin in muscular elasticity.

Therefore, stretching exercises seem to acutely produce a decrease in viscosity of the tendinous structures, allowing muscle fibers to slide with less resistance to movement. At the same time, stretching exercises generate an increase in muscle compliance that may limit more crossbridge coupling, thus decreasing the capacity of the muscle to produce force.

Chronic studies with stimuli of longer duration may help to improve understanding of the structural adaptations and their effects on strength performance resulting from stretching exercises.

Static stretching decreased MVC only when the muscle was not on tension in 1 study on knee extension (Nelson et al., 2001). In the only other study looking at joint positions, this did not occur (Fowles et al., 2000). In this latter study, the plantar flexors were tested with the knee at 90° flexion and the ankle at 0°, 10°, and 20° dorsiflexion. The object of the study was to test the soleus muscle (on/off tension at different positions used). One study reported that the diminished performance was limited to slow contraction speeds during isokinetic testing, but another study found the effect at multiple joint velocities (Cramer

et al., 2004). Both studies used similar ranges of velocities (results at very high velocities demonstrate more variability) (Handel et al., 1997), and there was no apparent methodological difference that would explain this discrepancy.

There was a decrease in the EMG in studies (Fowles et al., 2000; Young and Behm, 2003; Behm et al., 2001; Avela et al., 1999) but not in (Evetovich et al., 2003) The time spent stretching in the study without a decreased EMG was similar to some of the studies that showed a decrease in EMG, suggesting that this was not the reason for the difference. The duration of the effect on the EMG was variable. Where only 1 limb was stretched, the EMG decreased in the unstretched leg with knee isokinetic testing (Cramer et al., 2004), but not in the study measuring MVC of the plantar flexors (Avela et al., 1999).

During the last two decades, several studies have been carried out with the aim of observing the hormonal changes due to stretching. Some studies were conducted with animals being immobilised in a stretched position for various days by casting. (Goldspink et al., 1995) observed that stretching increased insulin-like growth factor (IGF)-1 messenger RNA (mRNA) levels in mice. (Yang et al., 1997) analysing possible hormonal alterations in rabbits, observed that stretching generated an IGF-1 isoform (IGF-1Eb), corresponding to the human IGF-1 Ec isoform which is related to muscular growth. They also observed increases in IGF-1 mRNA levels, which correlated with increases in muscle mass in rabbits. IGF-1 Ec, also known as mechano growth factor (MGF), is an IGF splice variant that has autocrine and paracrine functions capable of stimulating protein synthesis and musile hypertrophy (Goldspink, 2005). A particular function of MGF is to activate satellite muscle cells (HILL and Goldspink, 2003). MGF generates a rapid increase in the number of ribosomal RNA, indicating that hypertrophy of the muscle fibers occur during translation. These findings showed that stretching is capable of promoting in creases in muscle strength or hypertrophy. Never theless, the experimental conditions of the studies are very different from the conditions normally recommended and applied to humans.

The purpose of the present study was to investigate the acute effects of performing two different stretching protocols on subsequent performance of vertical jumps. We expect different responses following the potentiating by stretching due to the order of their types.

Methods

Subjects

Twenty-four men were recruited for this study. Their physical characteristics [mean ± standard deviations (SD)] were: age 22,4 ± 2,5 years, height 1,79 ± 0,13 m, body mass: 76,7 ± 9,1 kg. The subjects were students of Faculty of Physical Education and Sport Comenius University in Bratislava and they were healthy without injuries of the muscle-skeleton system. All had experience in sport training. During the last 4 months they trained systematically 2 – 3 times a week.

Experimental design

This study investigated the effects of static versus dynamic stretching potentiation on a series of vertical jumps in men. From a contact platform (FitroJumper), variables of jump height were calculated for each jump. This design allowed for the determination of the effectiveness of stretching as a potentiating exercise, given that previous research has

reported individual responses in the timing of the potentiation response and few studies have analyzed the response of different types of stretching separately.

All subjects participated in three testing sessions of vertical jumps. They performed one session prior to any of the other sessions, and the order of the potentiation was counterbalanced across the subjects. Each subject performed two jumps with (CMJ) and without counter movement (SJ) every three minutes for a total of 4 jumps following each of the treatments.

The subjects randomly executed one session of vertical jumps, two with and to without counter movement before specific warm-up. Then subjects in one session used first static stretching at duration 30 second on 6 positions of main muscle groups that are activated in vertical jumping. In order: 1. plantar flexors, 2. hamstrings, 3. knee extensors, 4. adductors, 5. gluteus, 6. spine erectors. Then they were tested with 3 min. rest on a series of vertical jumps. After that, with another 3 min. rest, they perform session of dynamic stretching (rapid swing action up to individual marginal position of range of movement) in duration of 30 second again on 6 main muscle groups and after that they performed testing of vertical jumps. On the other hand with 48 hours break was design repeated but in reverse direction of stretching types. It means first dynamic and after static stretching with the same duration and same muscle groups involved.

Measurements

Standing (SJ) and Countermovement Jump (CMJ) height: The subjects performed SJ and CMJ with the hands firmly grasping a light wooden bar, which was resting on the shoulders, was performed. The height of the jump was calculated by the time of flight with the use of a contact platform connected to a digital timer (FitroJumper, Bratislava, Slovakia) using the formula: Jump height (m) = 9,81 $m.s^{-2}$ X flight time $(s)^2$ / 8 (Bosco et al., 1983). Subjects were instructed to keep their legs extended and beneath them during the jump performance because excessive bending at the knee coupled with landing in an exaggerated bent knee position could result in a false jump height calculation. Two jumps with a 30 sec inter trial rest period were performed and the highest one was included in the statistical analysis. The study of Smilios et al. (2005) were conducted intra-class correlation coefficient was found to be high for SJ and CMJ, r = 0,949.

Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS for Windows, version 16.0) Measures of central tendency and spread of the data were represented as means and standard deviations. A two way ANOVA with repeated measures on the second factor was used to examine the effects of the two warm-up protocols on counter movement jump height. For the examination of each protocol's effect a T-test for dependent samples was used. Significant differences between means were located with the significance level at $p \leq 0,01$ resp. 0,05.

Results

First static and after dynamic stretching

The effect of warm up by static and after that dynamic stretching session was characterized by decreasing of the standing jump (SJ) height. It decreased after static stretching (SS) form 36,1 ± 4,4 cm to 35,1 ± 4,2 cm by 2,81 % (p = n.s.). Then after dynamic stretching session standing jump (SJ) height increased up to 37,1 ± 4,6 cm by 2,67 % but it was not significant from values before warm up (p = n.s.; Figure1).

Similar effect, but not the same at all, of static and after that dynamic stretching session was observed in the counter movement jump (CMJ) height. It decreased after the static stretching (SS) significantly form 38,5 ± 4,8 cm to 36,8 ± 4,4 cm by 4,58 % ($p \leq 0,05$). Then after dynamic stretching session, with 3 min. break after first measurement, the CMJ height increased up to 39,5 ± 4,0 cm by 2,46 % but it was not significant from values before warm up (p = n.s.; Figure2)

First dynamic and after static stretching

The effect of dynamic stretching (DS) is more accentuated without previous using of static stretching (SS). When DS was used earlier than (SS) there was observed increase on the standing jump (SJ) height form 33,8 ± 3,4 cm to 35,9 ± 3,8 cm by 6,33 % ($p < 0,05$), Then after static stretching session standing jump (SJ) height decreased to 34,1 ± 2,6 cm it was by 1,12 % higher from values before warm up (p = n.s.; Figure 3) The results of the study show that the inclusion of a dynamic stretching exercises in the warm-up improve jumping performance more that when the static stretching is used before.

This effect is more pronounced on the CMJ height. After session of dynamic stretching (DS) there was observed increase form 35,3 ± 4,5 cm to 37,7 ± 3,9 cm by 6,92 % ($p < 0,01$). Then after static stretching session CMJ height decreased to 35.5 ± 4.1 cm it was by 0.79 % higher from values before warm up (p = n.s.; Figure 4) Application of a dynamic stretching exercises in the warm-up improve jumping performance with countermovement more than without rapid eccentric contraction.

Discussion

Significant increase in height of jump following the potentiation treatment was observed only when the dynamic session was on the first place. Several studies have investigated the acute effect of stretching exercises on vertical jump performance. (Church et al., 2001) reported a significant decrease in performance when this was preceded by PNF stretching, but not by static stretching. This confirms the findings of (Power et al., 2004 and Knudson et al., 2001) that investigated the effects of static stretching and also found no significant decreases in vertical jump performance. On the other hand, two studies did not find decreases in vertical jump performance in trained women either after PNF stretching and following static or ballistic stretching (Unik et al., 2005) Other studies found decreases in vertical jump performance after static stretching (Cornwell et al., 2002), ranging from – 4,5 % to – 7,3 % and – 3,2 % to – 4,4 % with and without counter movement, respectively.

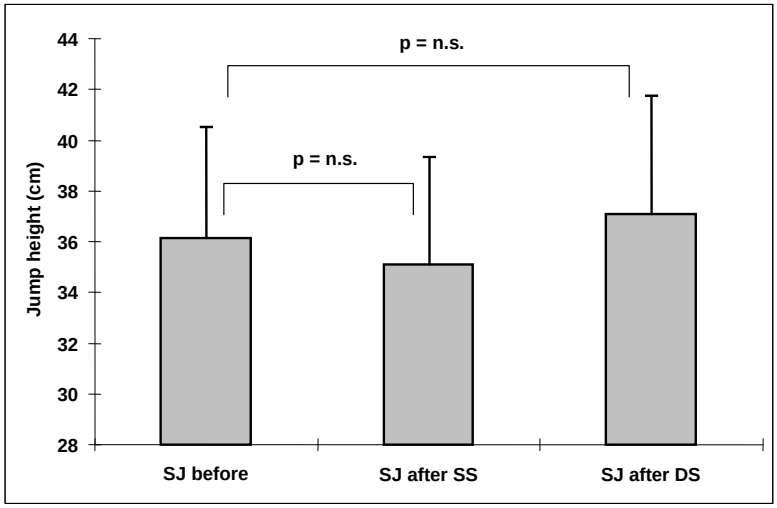

Figure 1

Countermovement jump (CMJ) height (mean ± SD) values before and after the execution of a warm up including first static (SS) and second dynamic (DS) stretching equal duration and same muscle group evolved (p ≤ 0,05 and 0,01 from values before warm up)

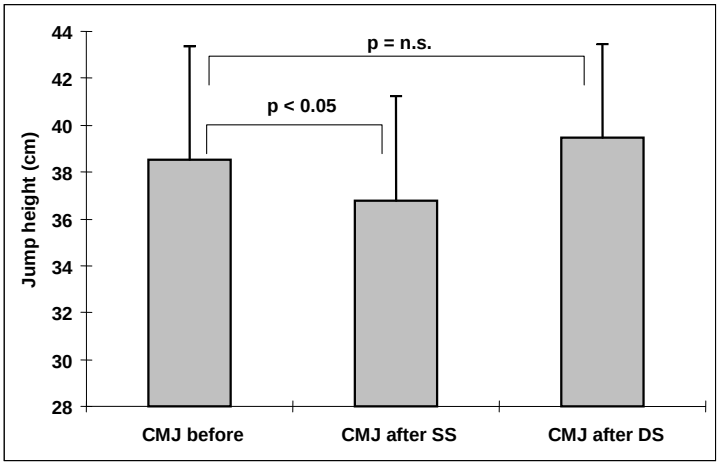

Figure 2

Standing jump (SJ) height (mean±SD) values before and after the execution of a warm up including first static (SS) and second dynamic (DS) stretching equal duration and same muscle group evolved (p ≤ 0,05 and 0,01 from values before warm up)

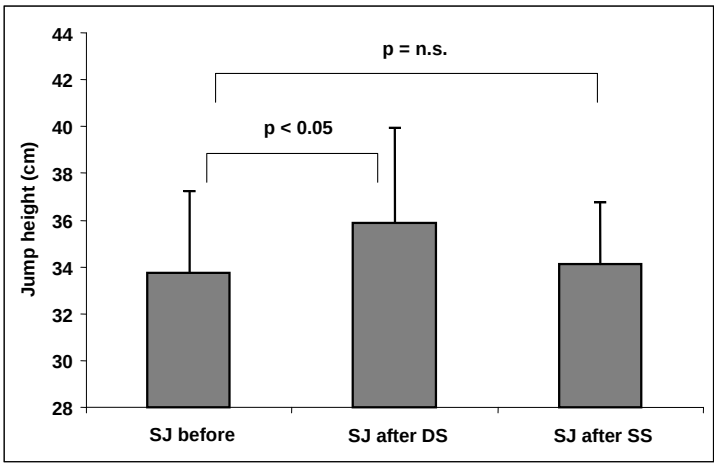

Figure 3

Standing jump (SJ) height (mean±SD) values before and after the execution of a warm up including first dynamic (DS) and second static (SS) stretching equal duration and same muscle group evolved ($p \leq 0,05$ and 0,01 from values before warm up)

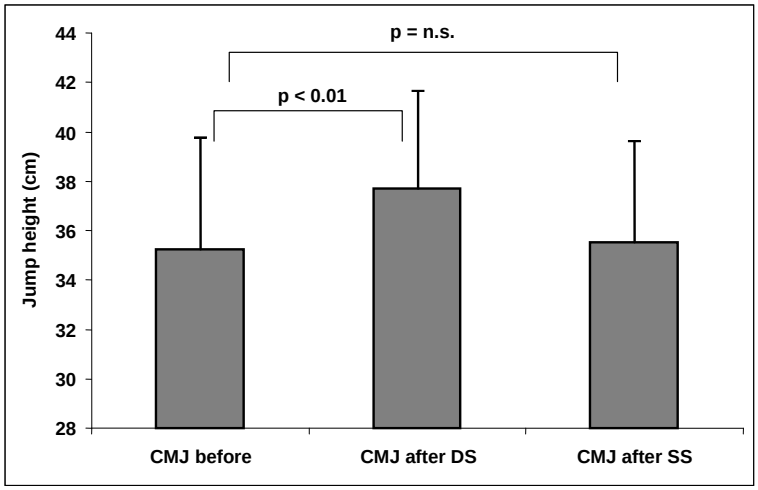

Figure 4

Countermovement jump (CMJ) height (mean ± SD) values before and after the execution of a warm up including first dynamic (DS) and second static (SS) stretching equal duration and same muscle group evolved ($p \leq 0,05$ and 0,01 from values before warm up)

An acute bout of stretching decreases the visco-elastic behavior of muscle and tendon (Magnusson et al., 1996; Halbertsma et al., 1999; Halbertsma et al., 1996). Because the stiffness is decreased, it requires less energy to move the muscle. This is consistent with the clinical finding that running economy is improved with an acute bout of stretching. The mechanism by which stretching would be detrimental in tests of performance related to force produced is most likely related to damage caused at the time of the stretch. The basic science literature suggests that strains as little as 20 % beyond resting fiber length can cause muscle damage, resulting in decreased force. A 20 % strain occurs in some sarcomeres with regular walking (Macpherson et al., 1996) and therefore is certainly to be exceeded by normal stretching routines. Further (Black and Stevens, 2001) found that an acute bout of stretching (5 % beyond resting length) in mice results in approximately 5 % decline in isometric force (control group).

We found that dynamic stretching was superior to static stretching in improving height of the jump. This strongly suggests that the effects seen were not due to increased ROM and therefore were not due to improved visco-elastic properties or running economy. Because dynamic stretching also requires the muscles to contract, other possible mechanisms include central programming of muscle contraction/coordination.

Muscle offers less resistance to passive stretching and increases its capability of distending when muscular compliance increases. This phenomenon is know as 'stress relaxation', which is a loss in tension occurring when the muscle is stretched with a constant length and which occurs irrespective of observed electromyographic alterations, as suggested by (Mchugh et al., 1992). Thus, muscle compliance resulting from static stretching is suggested as one of the mechanisms responsible for the decrease in muscular performance.

Another study (Fowles et al., 2000) found that there was a decrease in motor unit activation and in electromyographic activity immediately following passive stretching of the plantar flexors. In addition, there was a 28 % decrease in maximum voluntary contraction, which was still depressed by 9 % 1 hour after stretching cessation.

In the study by (Avela et al., 1999) maximum voluntary activation was decreased by 23,2 % immediately following 1 hour of repeated passive stretching of the triceps surae. The authors observed a reduction in sensitivity to repeated stretches of the muscle spindles, reducing the activity of the large-diameter afferents and producing smaller electromyographic amplitude. In addition to these mechanisms, other neural systems may be involved, such as activation of nociceptors and inhibition generated by Golgi tendon organs, which contribute to a decrease in excitability of the α motoneuron (Behm et al., 2001). An increased inhibitory drive of the α motoneuron pool generated by types III and IV joint receptors after stretching exercise was also suggested by (Avela et al., 1999).

Therefore, there seems to be a reduction in sensibility of the muscle, tendon, joint receptors and nociceptors, which are fundamental mechanisms for the protection of structures involved in motion. In addition to these alterations, there is a period where neuromotor responses are delayed immediately following stretching exercises. These acute neural alterations may be related to the observed decrease in strength and may predispose to not only decrease performance, but also increase the risks of injury. An acute stretch can produce an analgesic effect (Magnusson et al., 1996; Halbertsma et al., 1999), which may in itself improves performance in injured athletes. For example, the stretch-induced analgesia may minimize pain-induced muscular inhibition, and this could theoretically improve

performance in an injured athlete. However, the analgesic effect of stretching may also affect other nerves aside from pain fibers (e. g., proprioceptive nerves), and the overall effect of stretching in this population remains to be determined.

In summary, the evidence suggests that static stretching immediately prior to exercise decreases the results on performance tests that require isolated force or power. On the other hand, regular stretching will improve the results for all activities. This is similar to the fact that stretching immediately prior to exercise does not reduce the risk of injury, but that regular stretching may reduce the risk of injury (Shrier, 2002). Therefore, if one stretches, one should stretch after exercise, or at a time not related to exercise (the relative benefit of each remains unstudied at the present time). Future research should investigate the cellular and molecular mechanisms by which the effects of stretching occur, whether the added benefit of regular stretching is as effective as other types of performance-enhancement exercises being promoted (e.g., plyometrics, increased weight training), and whether the same effects are seen in the presence of injury.

Limitations of the study

Although most studies used a randomized crossover design (the strongest evidence of causality), some studies used a pre-post design. Results were generally consistent across designs. There are many different ways to stretch. Static stretching was used in most of the studies, but the effects were observed with PNF stretching as well. Dynamic stretching is a combination of both stretching and warm-up (i. e., muscle is contracting). Although different models of stretching produced conflicting results, another methodological difference was the duration of stretch, with the longer stretch producing worse results.

It is not possible to blind a subject as to whether they stretched or not. However, in the 1 study in which subjects were asked, all believed that an acute bout of stretching would improve performance (Nelson and Kokkonen, 2001) Where the results were in the opposite direction of the prior beliefs, lack of blinding could only mean that the effect was even greater than we observed, and that it is likely that an acute bout of stretching affects performance through physiological and not psychological mechanisms. The subject population is a very important variable to consider. These studies found similar results across gender, age, and level of athletic talent. This also suggests the results are due to basic physiological changes that occur in the muscle, a hypothesis that is supported by the basic science evidence on stretch-induced muscle damage and stretch-induced hypertrophy. Finally, the improved performance, if it did occur, might be at the expense of an increased risk of injury. The advantages and disadvantages of stretching need to be weighed for each athlete, including but not limited to competition level, competition timing (e. g., early or late in the season).

Conclusion

There seems to be large differences between the orders of stretching types in the response to height of jumps. The use of dynamic stretching performed prior to vertical jumps can result in improvements in performance in certain subjects, the gains were 6,3 % in SJ ($p < 0,05$) and 6,9 % in CMJ ($p < 0,01$) higher from values before warm up. After that was used static stretching that decreased down the value of jumps height but there were still higher from the values before warm up about 1,12 % for SJ and 0,79 % for CMJ ($p = n.s$).

When the session of static stretching was used on the first place the decreasing of the jumps height was observed. SJ height decreased after static stretching (SS) from values before warm up by 2,81 % (p = n.s.) and for CMJ by 4,58 % ($p \leq 0,05$). After that with only 3 min. rest was performed dynamic stretching session and SJ height increased by 2,67 % and CMJ by 2,46 % but it was not significant from values before warm up.

As such, if sport practitioners wish to use first static stretching methods, an attempt should be leads to significant decrease in performance in vertical jumps. Practitioners should demonstrate caution as subsequent vertical jump performance in certain subjects can actually be hindered by the use of prior static stretching and facilitated by the use of prior dynamic stretching. When the static stretching is used firstly reflex sensitivity is attenuated and facilitation by following dynamic movement is not as much as effective. Similarly, consideration should be given to the mechanical variable that is selected to demonstrate an improvement following such protocols given the likely disparate responses in individual subjects.

References

1. AVELA, J., KYROLAINEN, H., KOMI, P. V. 1999. Altered reflex sensitivity after repeated and prolonged passive muscle stretching. *J Appl Physiol.* 1999; Vol. 86, pp.1283-1291.
2. BEAULIEU, J. E. 1981. Developing a stretching program. *Phys Sportsmed*. 1981; Vol. 9, pp. 59–65.
3. BEHM, D. G., BUTON, D. C., BUTT, J. C. 2001. Factors affecting force loss with prolonged stretching. *Can J Appl Physiol*. 2001; Vol. 26, pp. 261-272.
4. BLACK, J. D., STEVENS, E. D. 2001. Passive stretching does not protect against acute contraction-induced injury in mouse EDL muscle. *J Muscle Res Cell Motil*.2001; Vol. 22, pp. 301-310.
5. BOSCO, C., LUHTANEN, P. and KOMI P. V. 1983. A simple method for measurement of mechanical power in jumping. *European Journal of Applied Physiology*.1983; Vol 51, pp. 129-135.
6. CHURCH, J. B, WIGGINS, M. S., MOODE, F. M. et al. 2001. Effect of warm-up and flexibility treatments on vertical jump performance. *J Strength Cond Res.* 2001; Vol. 15, No. 3, pp. 332-336.
7. CORNWELL, A., NELSON, A. G., SIDAWAY, B. 2002. Acute effects of stretching on the neuromechanical properties of the triceps surae muscle complex. *Eur J Appl Physiol.* 2002; Vol. 86, pp. 428-434.
8. CRAMER, J. T., HOUSH, T. J., JOHNSON, G. O. et al. 2004. The acute effects of static stretching on peak torque in women. *J Strength Cond Res.* 2004; Vol. 18, pp.236-241.
9. EMAN, K. A., TSUCHIYA, T. 1996. Strain of passive elements during force enhancement by stretch in frog muscle fibres. *J Physiol.* 1996; Vol. 490, No. 1, pp. 191-205.
10. EVETOVICH, T. K., NAUMAN, N. J., CONLEY, D. S., et al. 2003. The effect of static stretching of the biceps brachii on torque, electromyography, and mechanomyography during concentric isokinetic muscle actions. *J Strength Cond Res.* 2003; Vol. 17, pp. 484-488.
11. FOWLES, J. R., SALE, D. G., MACDOUGALL, J. D. 2000. Reduced strength after passive stretch of the human plantarflexors. *J Appl Physiol*. 2000; Vol. 89, pp. 1179-1188.
12. GOLDSPINK, G. 2005. Mechanical signals, IGF-1 gene splicing, andmuscle adaptation. *Physiology.* 2005; Vol. 20, pp. 232-238.

13. HALBERTSMA, J. P. K., MULDER, I.., GOEKEN, L. N. H. et al. 1999. Repeated passive stretching: acute effect on the passive muscle moment and extensibility of short hamstrings. *Arch Phys Med Rehabil.* 1999; Vol. 80, pp. 407-414.
14. HALBERTSMA, J. P. K., VAN BOLHUIS, A. I., GOEKEN, L. N. H. 1996 Sport stretching: effect on passive muscle stiffness of short hamstrings. *Arch Phys Med Rehabil.*1996; Vol. 77, pp. 688-692.
15. HANDEL, M., HORSTMANN, T., DICKHUTH, H. H. et al. 1997. Effects of contract-relax stretching training on muscle performance in athletes. *Eur J Appl Physiol Occup Physiol.* 1997; Vol. 76, pp. 400-408.
16. HILL, M., GOLDSPINK, G. 2003. Expression and splicing of the insulin-like growth factor gene in rodent muscle is associated with muscle satellite (stem) cell activation following local tissue damage. *J Physiol.* 2003; Vol. 549, No. 2, pp. 409-418.
17. KNUDSON, D., BENNETT, K., CORN, R. et al. 2001. Acute effects of stretching are not evident in the kinematics of the vertical jump. *J Strength Cond Res.* 2001; Vol. 15, No. 1, pp. 98-101.
18. KUBO, K., KANEHISA, H., KAWAKAMI, Y. et al. 2001. Influence of staticstretching on viscoelastic properties of human tendon structures in vivo. *J Appl Physiol.* 2001; Vol. 90, pp. 520-527.
19. KUBO, K., KANEHISA, H., FUKUNAGA, T. 2002. Effects of resistance and stretching training programmes on the viscoelastic propertiesof human tendon structures in vivo. *J Appl Physiol.* 2002; Vol. 538, No. 1, pp. 219-226.
20. MACPHERSON, P. C. D., SCHORK, M. A., FAULKNER, J. A. 1996. Contraction-induced injury to single fiber segments from fast and slow muscles of rats by single stretches. *Am J Physiol.* 1996; Vol. 271, pp. 1438-1446.
21. MAGNUSSON, S. P., SIMONSEN, E. B., AAGAARD, P. et al. 1996. A mechanism for altered flexibility in human skeletal muscle. *J Physiol* (Lond). 1996; Vol. 497, pp.291-298.
22. MCHUGH, M. P., MAGNUSSON, S. P., GLEIM, G. W., et al. 1992. Viscoelastic stress relaxation in human skeletal muscle. *Med Sci Sports Exerc.* 1992; Vol. 24, No. 12, pp. 1375-1382.
23. MCNEAL, J. R. & SANDS, W. A. 2001. Static stretching reduces power production in gymnasts. *Technique*. 2001; Nov/Dec, pp. 5-6.
24. MINAJEVA. A., KULKE, M., FERNANDEZ, J. M. et al. 2001. Unfolding of titin domains explains the viscoelastic behavior of skeletal myofibrils. *Biophys J.* 2001; Vol. 80, pp. 1442-1451.
25. NELSON, A. G., ALLEN, J. D., CORNWELL, A. et al. 2001. Inhibition of maximal voluntary isometric torque production by acute stretching is joint-angle specific. *Res Q Exerc Sport.* 2001; Vol. 72, pp. 68-70.
26. NELSON, A. G., KOKKONEN, J. 2001. Acute ballistic muscle stretching inhibits maximal strength performance. *Res Q Exerc Sport*. 2001; Vol. 72, pp. 415-419.
27. POWER, K., BEHM, D., CAHILL, F. et al. 2004. An acute bout of static stretching: effects on force and jumping performance. *Med Sci Sports Exerc*. 2004; Vol. 36, No. 8, pp. 1389-96.
28. RUBINI, E. C., GOMES, P. S. C. 2004. Protein titin and its application on muscle elasticity: a short review. *Revista Brasileira de Fisiologia do Exerc´icio.* 2004; Vol. 3, No. 1, pp. 26-30.
29. SHRIER, I. 2002. Does stretching help prevent injuries? In: MACAULEY, D., BEST, T. *Evidence-Based Sports Medicine*. London: BMJ Publishing Group; 2002, pp. 97-116.
30. SMILIOS, I., PILIANIDIS, T., SOTIROPOULOS, K., ANTONAKIS, M. and TOKMAKIDIS, S. P. 2005. Short-term effects of selected exercise and load in contrast training on vertical jump performance. *Journal of Strength and Conditioning Research*. 2005; Vol.19, No. 1, pp.135-139.
31. STAMFORD, B. 1984. Flexibility and stretching. *Phys Sportsmed*. 1984; Vol. 12, pp.171-73.
32. TSKHOVREBOVA, L., TRINICK, J. 2001. Flexibility and extensibility in the titin molecule: analysis of electron microscope data. *J MolBiol.* 2001; Vol. 310, pp.755-71.

33. UNIK, J., KIEFFER, H. S., CHEESMAN, W. et al. 2005. The acute effects of static and ballistic stretching on vertical jump performance in trained women. *J Strength Cond Res.* 2005; Vol. 19, No. 1, pp. 206-212.
34. YANG, S., ALNAQEEB, M., SIMPSON, H. et al. 1997. Changes in muscle fibretype, muscle mass and IGF-I gene expression in rabbit skeletalmuscle subjected to stretch. *J Anat* 1997; Vol. 190, pp. 613-622.
35. YOUNG, W. B., BEHM, D. G. 2003. Effects of running, static stretching and practice jumps on explosive force production and jumping performance. *J Sports Med Phys Fitness*. 2003; Vol. 43, pp. 21-27.

RESUMÉ

VPLYV STREČINGU NA PARAMETRE VÝBUŠNEJ SILY

Marián Vanderka

Cieľom práce bolo zistiť okamžité efekty dvoch rôznych typov strečingu na úroveň výbušnej sily hodnotenej vertikálnym výskokom. 24 subjektov náhodne vykonávalo dva výskoky s protipohybom (CMJ) a bez proti pohybu (SJ), pred a po dvoch rôznych typoch strečingu rovnakého trvania zameraného na 6 svalových skupín nesúcich hlavné zaťaženie pri tomto type pohybu. Výšku výskoku sme stanovili podľa trvania letovej fázy pomocou výskokového ergometra (Fitrojumper). Zistili sme, že dynamický strečing má pozitívny okamžitý efekt na výšku výskoku, zatiaľ čo statický strečing pôsobí na tento parameter negatívne. Dynamická forma strečingu mala za následok zvýšenie výkonu o 6,3 % SJ ($p < 0,05$) a 6,9 % v CMJ ($p < 0,01$). Statický strečing spôsobil zníženie výšky výskoku o 2,81 % pre SJ ($p = ns$) a pre CMJ o 4,58 % ($p \leq 0,05$). Preto môžeme odporučiť, a to nie len pred výbušnými výkonmi, používať skôr dynamické formy strečingu, pretože následné výkony sú z hľadiska okamžitých účinkov statického strečingu ovplyvňované negatívne.

NEUROMUSCULAR CONTROL OF THE KNEE JOINT IN ADOLESCENT FEMALE VOLLEYBALL PLAYERS

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Summary: The aim of this article is to evaluate neuromuscular control in a selected group of female volleyball players, which is hoped to be a foundation for a quality dynamic stabilization of the knee joint. Furthermore it should be a verification of the influence of exercise in closed kinetic chain series and the proprioceptive training for neuromuscular control of the knee. The researched group consisted of five female players between the ages of 15 to 16-years old. For the examination we selected methods, which are used in diagnostics of deviations in the lower extremity joints positioning in the anterior and sagittal plane and malfunctions of the neuro-muscular stabilization of the lower extremity joints (questionnaire, plummet, and function tests.)

The results suggest that proprioceptive training and exercise in a closed kinetic chain series influence the neuromuscular joint control as well as the positioning of individual joints of the lower extremities in the anterior and sagittal planes. This can contribute to risk reduction in damaging the anterior cruciate ligament, but also other injuries to the lower extremity joints. Based on the established results the researchers recommend the inclusion of neuromuscular training into the training process, especially in youth categories in order to improve the lower extremity stabilization and reduce lower extremity injury.

Key workds: volleyball, knee joint, proprioceptive training, neuromuscular control.

Introduction

A number of studies (Hewett, 2005; Schults, 2001; Westin-Barber, 2005, etc.) indicate a 4 – 6 times higher incidence of serious injuries to the soft tissue structure of the knee in adolescent females rather than male players within the same age category involved in sports requiring frequent landing, movement deceleration, and fast changes in running direction, where optimal passive and dynamic stabilization is required.

Every year in the USA there are more than 30, 000 serious injuries to knee joint soft tissue structures in adolescent female athletes. Most of these knee injuries are caused by a non-contact mechanism, very often during a load while landing. It is one of the fundamental tasks of the athlete, as well as the trainer, to prevent injuries and over-extension of the extremities and, at the same time, to attain good results. The initial determination of the damage is necessary for subsequent injury therapy, since it is common for an athlete to continue in sport activities with a serious injury and this, from a long-term perspective, worsens the condition even further. A second, more serious error, is when

following a correctly treated injury or over-extension an athlete begins too early with an unsuitable sport activity, where the not--fully--healed damage becomes a chronic condition. New, often unsuitable motoric programs are created due to pain, insufficient joint mobility, muscle shortening or weakening in the location of the injury and improper timing of the muscles involved in movements of a given segment. These negative effects present themselves not only in a certain segment, but also in the movement expression of the whole individual through muscle knots and can lead to linked muscular problems and a development of a functional pathology in a further segment. The healing of the ligaments of the individual joints, bone healing, the induction of optimal neuromuscular stabilization of the individual segments of the movement apparatus and the timing of muscles involved in movements of the given segment as well as the whole are important, because the disorders stemming from these limit athletes from giving a proper performance.

Volleyball belongs among the sports where incidents of serious injuries to the soft tissues of the knee are relatively common. The number of jumps and subsequent landings from various heights results in frequent chronic knee injuries in volleyball players. Over-extension manifests itself most in the tendons of the quadriceps in the knee joint area. Chronic problems of this type are known as "jumper's knee." Another typical injury to the knee in volleyball is a ligament tear or partial tear or meniscal injuries (Ferretti, 1994).

In this report the authors deal with malfunctions of the neuromuscular control of knee joint stabilization in adolescent (16 years old) female volleyball players. This age is, according to the statistics, one of the most high frequency, in terms of soft tissue injuries to the knee joint. A number of studies state that this age, in connection with the inability of the soft tissue (ligaments, muscles) to react adequately through optimal static and dynamic stabilization due to the hormonal changes connected to maturation and to fast growth.

This inadequate quality of dynamic joint stabilization is demonstrated during landing on one hand either by the locking of the knee into hyper-extension or, on the other hand, by "a medial collapse" of the knee joint, due to valgus placement, connected to the internal rotation and adduction of the hip joint, the external rotation of the tibia and foot pronation. This phenomenon occurs due to unbalanced knee joint muscle co-activation, but also to the hip joint muscles and foot and calf muscles. The dynamic knee joint stabilization occurs during various motor stereotypes in the antero-posterior, mediolateral directions, and to a great extent the position of the proximal segments, hip, pelvis, spine and distal segments and foot positioning play a role as well. Due to a wider pelvis in women there is a greater tendency toward internal rotation and adduction of the hip. In connection to this valgus positioning of the knee, talus and foot pronation occur. The inclination of women to the aforementioned lower extremity joint positioning is connected to the malfunction of co-activation between the lateral pelvis stabilizers and internal rotators and adductors of the hip, between m. quadriceps and the antagonist group of hamstrings and between the *vastus medialis* and the *vastus lateralis* of the *m. quadriceps femoris*. It can be surmised that the timing malfunction of the aforementioned muscles significant for stabilization can, in certain pathokineziological circumstances, add to the insufficient neuromuscular stabilization of the knee and a potential progression of irreversible pathology in the bone structure, but also, in soft structures of the knee, ligaments, joint capsules and menisci.

Aims

From a selected group of female volleyball players neuromuscular control will be assessed, which should be the basis for a quality dynamic knee joint stabilization, followed by verification of the influence of exercise in a closed kinetic chain series, proprioceptive training on neuromuscular control of the knee.

Methods

The Characteristics of the Research Sample

This is a case of an intentional selection, where players were chosen from one team consistently ranking among the three best in the Czech Republic. The criterion for the selection was finding a change in the positioning of both lower extremity joints (DKK) on the anterior or sagittal planes. The sample consisted of five female players between the ages of 15 and 16 years old. Their average height was 180 centimetres and their average weight was 66.5 kilograms. They had played volleyball for 4 – 6 years and had trained 4 times weekly for two hours each session.

The Character of the Research

This is a case of a pedagogical experiment on a purposefully selected group of female volleyball players. The effects of the proprioceptive training were examined based on a comparison of the pre-test and post-test. The description of the course of manipulation with the variables, i. e., the proprioreceptive training, is provided in the appendix at the end of this report.

Applied Methods

For the examination the selected methods were those employed in the diagnostics of variances in the DKK positioning in the anterior and sagittal planes and malfunctions of neuromuscular joint stabilization. Specifically, a medical history questionnaire, goniometry and functional testing, i. e., knee bend and landing, were used. Goniometry is a set of methods focusing on measuring angles in the joints. A Plumb line and goniometers were used for the measurements. The joint DKK configuration in the anterior and sagittal planes was evaluated with the plumb line.

The positioning of the knee, hip joints and the foot in the anterior plane were evaluated through measuring from the front. Measuring from the side was carried out on the sagittal plane. Both measurements were carried out barefoot. During the functional testing of the knee bend, which serves in order to reveal malfunctions of the neuromuscular control of the knee, the players were tested barefoot on a floorboard. The movement began from a starting position, where the DKK were at a pelvis width apart, the arms hung freely along the sides, the head extended straight up from the torso. During the test, every player moved to such an extent that her sitting bones touched the pre-prepared “stops,” whose height were equivalent to the measured perpendicular distance of their sitting bones from the ground and equal to a flexion of 30° in the knee joint. The “stop” was a height-adjustable obstacle.

The chosen angle of flexion in the knee of 30° is, according to the authors Magee (2002) and Bartoníček (1986), the value of an angle, where the overload of the anterior cruciate ligament does not occur. The aforementioned angle was determined with a contact lever goniometer and, at the same time, the perpendicular distance of their sitting bones

from the ground was measured in every player. The length of this line was determined with a tape measure.

The monitored aspects were: knee joint "medial collapse", foot pronation, thigh muscle tremor, coordinated movement of the torso and upper extremities, asymmetry in body weight distribution on DKK. The landing belongs among the most often reoccurring movements in volleyball, which was the main reason for the selection of this movement as the functional test. Landings were executed in indoor shoes from a 40-centimeter-high vaulting box onto a floorboard, onto both of the lower extremities, onto the dominant as well as the non-dominant leg. During landing onto one leg the other one was flexed at the knee. The height of the vaulting box was selected based on the average height of the players' jump.

The monitored aspects were: knee joint "medial collapse" connected to VR and ADD of the hip and foot pronation (Table 1) during the landing phase, the lateral pelvic shift, the coordinated movement of the torso and upper extremities and the locking of the knee in hyperextension. Both of the functional tests were filmed with a digital camera preceding as well as following the applied therapy and the results were subsequently compared.

Note to the Standardization of the Conditions

The stability of the filmed image was supported via a portable tripod set to a height of 120 centimetres in order to record the positioning of movement of the torso, upper extremities, pelvis, hips, knees and leg during the aforementioned tests. The distance of the video camera from the player was 3.6 meters. In order to better judge the change in the upper extremity joint positioning during the aforementioned movements, there were yellow orientation markers with a diameter of 17 millimetres taped to specified places on the players.

Location of the orientation markers:

– *spina iliaca* anterior superior bilateral

– the centre of the patella bilateral

– distal part of the tibia, talotibial joint bilateral

Results

Positioning of the Lower Extremities on the Anterior Plane (looking from the front)

The positioning of the DKK before as well as after therapy is summarized in Table 1.

The Lower Extremities Positioning on the Sagittal Plane (side view)

There was an apparent hyper-extended knee positioning with one of the players before therapy. It was no longer apparent after the therapy.

Functional Testing of the Knee Bend

With all of the players before therapy, a "medial collapse" of the knee was found on DKK to an individually different degree. Four out of the five players had a "medial collapse" of the knee, to a greater extent; on the right lower extremity, i. e., their non-dominant. With one player it was a symmetrical collapse of both extremities. Before the therapy an imbalance in body weight distribution between the lower extremities was found

in four players, i.e., more weight on the left lower extremity. After the therapy the "medial collapse" of the knee joint was not present in any of the players and an equal body weight distribution of both of the lower extremities was determined in three out of four players with the imbalance.

Table 1

Changes in the DKK Positioning Preceding and Following Therapy

	Foot Pronation		**Hip Joint VR**		**Hip Joint ZR**		**Body Weight Distribution**	
	before therapy	after therapy	before therapy	after therapy	before therapy	after therapy	before therapy	after therapy
DKK (both)	**3**	**2**	**1**				**4**	**2**
LDK (left)			**2**					**2**
PDK (right)	**2**	**1**	**2**	**2**	**2**	**2**	**1**	**1**

Functional Testing of the Landing onto Both Feet

During this test the "medial collapse" of the knee was present in both DKK for four players and on the right lower leg with one. With two out of five players there was an apparent disproportionate load of the DKK, in terms of a bigger load on the LDK. After the therapy the "medial collapse" of the knee had been eliminated in only one player. In the four other players it was still present, but to a lesser degree; with one player on the DKK, with two players on the PDK and with one player on the LDK. The body weight distribution between the DKK had improved in two of the aforementioned players.

Functional Testing of the Landing onto the Dominant and Non-dominant Lower Extremities

Before the therapy all players had, to an individually different degree, a "medial collapse" of the knee on the dominant as well as the non-dominant lower extremity during landing. After the therapy there was no elimination of the "medial collapse" in the dominant lower extremity in any of the players. For the non-dominant foot, there was a visible improvement with some of the players. In one of the players there was no "medial collapse" of the knee present at all.

Discussion

The attained results confirm the findings of the Hewett study (2005) that the distal segment position influences the positioning and the neuromuscular control of the knee, i. e., an interstitial joint between the talus and the hip.

In our study, a modified position of the hip or the talus or both on the same or both lower extremities was present in most of the female players. A modified position on the

anterior plane demonstrated itself during the execution of the functional testing, where the "medial collapse" of the knee took place to an individually different extent, depending on the extent of the determined pathology. As a result, we can state that in our case there is a direct connection between the pathology in the lower extremity joint positioning and the extent of the pathological execution of the functional testing.

Further, we concur with the statement by Hewett (2005) and Mayer (2004) that in women, i. e., adolescent females, there is a lowered co-activating function in the medio-lateral direction between the vastus medial and vastus lateral of the *m.quadriceps femoris* and between the medial and lateral group of hamstrings, i.e., *m. semimembranosus* and *m. semitendinosus* x *m. biceps femoris*, which, demonstrated itself during our function tests as a "medial collapse" of the knee. The positioning, respectively, the muscle coordination in the hip and the talus area, as mentioned above, also plays a large role on the development of the "medial collapse" of the knee. In the hip joint area, one can attribute the lowered co-activation to an imbalance in the activation between the medial pelvis stabilizers, inner rotators and hip joint adductors. The lowered co-activation is true as well in the talus joint area between the supinators and foot pronators.

Our research did not confirm that the female knee during a load has a tendency to lock in hyperextension. The hyperextension position of the knee on the sagittal plane while standing was apparent only in one player. There was an adjustment made during the therapy that followed. Also, the functional tests of landing onto both lower extremities, i. e., onto the dominant and non-dominant lower extremities, did not confirm a tendency toward locking of the knee into hyperextension under load. During the functional tests the "medial collapse" of the knee joint was dominant. The authors believe that the locking of the knee into hyperextension presents itself only during lower extremity muscle fatigue following a load. A change in muscle co-activation takes place in favour of *m. quadriceps femoris*, participating in the knee stabilization in the antero-posterior direction. The ligaments take on the function of the fatigued muscles. It would be interesting to detect the manner of the knee joint stabilization during a game, where a completely automatic selection of the motoric program takes place according to the current situation without the player's conscious involvement. Based on this, we could then fully rebut the statement that under load the female knee has a tendency toward locking in hyperextension. The authors agree with the statement from the Hewett study (2005) that under load, i. e., during landing, the lowered activity of the gluteus muscles influences the hip joint into the inner rotation and leads toward the valgus placement of the knee.

During the functional test of landing onto both lower extremities, our results reflect the same as the results of Myer (2005) and Hewett (2006) and point to an improvement of the dynamic knee joint stabilization. On the contrary, during the functional test of landing onto one lower extremity, no significant influence was detected in our research group. This "failure" is explainable by the high demands on joint stabilization during landing onto one lower extremity. In terms of influence on our results, we are aware of several factors that might have caused them:

– influence of a long-term fixed motoric program

– insufficient motivation and concentration

– lack of influence of the primary place of the disorder

Véle (1997) states that the problem of sport games, to which volleyball belongs, is the high speed of carrying out the movement skills. There is no emphasis on the slow and coordinated, purposely directed movement execution in these moves. This leads to prolonging, if not preventing, the acquisition of a new motoric program into the subconscious. It is therefore questionable, whether it is at all possible to influence movement stereotypes for the landing and the knee bend during a game activity where these are long-term fixed and completely automatic-controlled by the CNS without consciousness.

Motivation and concentration also have a great influence on the acquisition of the new motoric program. Since the proprioceptive exercises preceded volleyball training, which took place in the evening hours, the players' concentration and motivation could have been lowered.

Finally, it is important to consider that the modified joint position of the lower extremity could have occurred only secondarily as a result of a functional or structural problem in the areas of the higher levels, i.e., the pelvis or the spine. As a result, if the primary source of the malfunction is not influenced, the secondarily occurring changes of the movement apparatus cannot take place. In contrast to Hewett (2006) and Myer (2005), who used for the objectification of their research a 3D analysis and Patern (2004), who used a Biodex stability system, the researchers' objectification method was the use of a digital video-camera in order to detect the positions of the lower extremities segments in the projection into the anterior plane. It is clear that the 3D analysis, as an objectification method for our research, would have been a more suitable selection, because the gathered data provide better evidence concerning the lower extremities and pelvis kinematics, due to the use of depiction in the three-dimensional space. Due to low accessibility of 3D analysis and financial reasons; however, the selection of this method was not possible.

Conclusion

The aim of this study was to evaluate the neuromuscular control of the knee joint with a selected group of female volleyball players, which was intended to be a basis for a quality dynamic stabilization of the knee joint. Moreover, it intended to verify the effects of selected exercises in closed kinetic chain series and proprioceptive training on the influence of the neuromuscular control of the knee.

The results suggest that the proprioceptive training and the exercises in closed kinetic chain series have influence on the neuromuscular control of the joint as well as on the placement of the individual joints of the lower extremities on the anterior and sagittal planes. This can add to the risk reduction in damaging the anterior cruciate ligament, but also other injuries to the joints of the lower extremities.

This conclusion corresponds to the conclusions of the authors Hewett (2006), Myer (2005) and Patern (2004), who also addressed the influence of the proprioceptive training onto the neuromuscular control of the knee joint and through its influence suppressing the development of the anterior cruciate ligament injury in adolescent female athletes.

Based on the established results, we suggest implementing the neuromuscular training into the training process, especially in youth categories in order to improve lower extremities' stabilization and the reduction of injuries to the lower extremities. This training should be preceded by quality stretching and warming up. During the exercise, motivation, concentration

on the movement, slow and conscious execution of the movements plays a great role in attaining positive results.

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APPENDIX

Proprioceptive Training and Exercise in Closed Kinetic Chain (CKC)

The aim of the proprioceptive training, which was chosen as therapy in order to improve the knee stabilization, is the accomplishment of the reflexive, automatic activation of the targeted muscles. The exercises were selected based on the findings gained from scientific literature and according to the possibility to include them into the training unit. The exercises were carried out by the players 4 times a week for approximately 10 minutes at the beginning of each training unit for a three-month period. The difficulty of the exercises was intensified every 3 weeks. The main criterion for the increase in demands was a perfect command of the preceding level.

1st Series (1st – 3rd week)

- Knee bends at the wall, knee pointing above the big toe 10x
- Stand on one lower extremity (DK) at the wall combined with a knee bend, knee pointing above the toe 10x for each lower extremity
- Knee bend at the wall with the toes turned outside at circa 15 – 20° 10x
- Step onto one DK on the sagittal and anterior plane while lifting 2nd DK from the mat, 5x for each DK

2nd Series (4th – 6th week)

Phase 1: the use of green Thera-band mat

- Step onto the Thera-band mat combined with lifting 2nd DK from the mat on the anterior and sagittal plane, 10x for each DK
- Step onto the Thera-band mat on the sagittal plane + throwing and catching the volleyball, 10x for each DK

Phase 2: The use of blue Thera-band mat

- Step onto the Thera-band mat combined with lifting 2nd DK from the mat on the anterior and sagittal plane, 10x for each DK
- Step onto the Thera-band mat on the sagittal plane + throwing and catching the volleyball, 10x for each DK

3rd Series (7th – 9th week)

The use of blue Thera-band mat

- Stand on 1 DK on the Thera-band mat, 90° flexion in the knee and the hip, 10x for each DK
- Stand on 1DK on the Thera-band mat + catching and throwing a ball, 10x for each DK

• Spring onto the Thera-band mat on the sagittal and anterior plane, 10x for each DK

4th Series (10th – 12th week)

The use of blue Thera-band mat

• Drop from a low box (15 cm) onto one DK onto the Thera-band, 10x for each DK

• Drop from a low box (15 cm) onto one DK onto the Thera-band mat on the sagittal plane combined with a vault onto 2nd DK onto a second Thera band mat on the anterior plane, 10x for each DK

• Stand on one DK on the Thera-band mat + ball throwing in pairs

The neuromuscular training influence onto the stability of the knee joint or the whole lower extremity was dealt with in their studies by Hewett (2006), Myer (2005) and Paterno (2004). In contrast to these studies, our approach was different in the length and frequency of the neuromuscular training, in the choice of the exercises and the functional tests, as well as the selection of the objectification methods.

References

1. FERRETTI, A. 1994. *Volleyball injuries*. 1. ed. Roma : F.I.V.B., 1994.
2. HEWETT, T. E., MYER, G. D. 2005. Biomechanical Measures of Neuromuscular Control and Valgus Loading of the Knee Predict Anterior Cruciate Ligament Injury Risk in Female Athletes. *Am. J. Sports Med*., 2005, 33.
3. HEWETT, T. E., ZAZULAK, B. T., MYER, G. D. 2005. A review of electromyographic activation levels, timing differences, and increased anterior cruciate ligament injury incidence in female athletes. *Br. J. Sports Med*., 2005, 39, s. 347-350.
4. HEWETT, T. E., MYER, G. D. 2006. The effects of plyometric versus dynamic stabilization and balance training on lower extremity biomechanics. *Am. J. Sports Med*., 2006, 34, s. 445-455.
5. MAGEE, D. J. 2002. *Orthopedic physical assessment*. Philadelphia : Elsevier science, 2002. ISBN 0-7216-9352-0.
6. MAYER, M., SMEKAL, D. 2004. Měkké struktury kolenního kloubu a poruchy motorické kontroly. *Rehabilitace a fyzikální lékařství, 2004,* č. 4, s. 111-117.
7. MYER, G. D. 2005. Neuromuscular training improves performance and lower extremity biomechanics in female athletes. J. *Strength and conditioning Research*, 2005, 19, s. 51-60.
8. PATERNO, M. V., MYER, G. D. 2004. Neuromuscular training improves single limb stability in young female athletes. *J. Orthopedic and sports Physical Therapy*, 34, s. 305 – 316.
9. VELE, F. 1997. *Kineziologie pro klinickou praxi.* Praha : Grada, 1997, s. 271. ISBN 80-7169-256-5
10. WESTIN-BARBER, D. S., GALLOWAY, M. 2005. Assessment of lower limb neuromuscular control in prepubescent athletes. *Am. J. sport Med*., 2005, 33, s. 1853 – 1860.

RESUMÉ

NERVOSVALOVÁ KONTROLA KOLENNÍHO KLOUBU U MLADÝCH HRÁČEK VOLEJBALU

Rostislav Vorálek – Monika Větrovcová – Vladimír Süss

Cílem příspěvku je posouzení nervosvalové kontroly u vybrané skupiny hráček volejbalu, která by měla být podkladem pro kvalitní dynamickou stabilizaci kolenního kloubu. Dále pak ověření vlivu cvičení v uzavřeních kinetických řetězcích; proprioceptivního tréninku na nervosvalovou kontrolu kolenního kloubu. Výzkumný soubor tvořilo pět hráček ve věku 15 – 16 let. K vyšetření jsme zvolily metody, které se využívají k diagnostice odchylek v postavení kloubů dolních končetin v rovině frontální a sagitální a poruch nervosvalové stabilizace kloubů dolních končetin (dotazník, olovnici a funkční testy). Výsledky naznačují, že proprioceptivní trénink a cvičení v uzavřených kinematických řetězcích má vliv na nervosvalovou kontrolu kloubu i na postavení jednotlivých kloubů dolní končetiny v rovině frontální a sagitální, což může přispět k redukci rizika poškození předního zkříženého vazu, ale i jiných poranění kloubů dolní končetiny. Na základě zjištěných výsledků doporučujeme zařazování nervosvalového tréninku do tréninkového procesu zejména u mládežnických kategorií pro zlepšení stability dolní končetiny a redukci zranění na dolní končetině.

THE EFFECTS OF SPORT TRAINING ON THE LEVEL OF FITNESS SKILLS DEVELOPMENT OF 11- TO 15-YEAR OLD BOYS

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Summary: Youth sport training is a special kind of physical education process, which has its own focus, aim and, together with construction, training process, competition policy, organization and management, it creates a complex and relatively autonomous system of child and youth training. It presents a certain type of intentional pedagogical influence, i. e. a planned training process in which we understand education and upbringing as specific influences mediated through sport pedagogical aims with respect to the goals of youth sport training. It focuses on the assurance of the optimum comprehensive development of youth and perspective increase of the sport performance of talented individuals through the impact of physical education and sport-means influence.

Key words: Youth sport training, fitness tests, young sportsmen, the population, statistical characteristics.

Introduction

The fact that the youth sport training fulfils its function (general and special) depends on the appropriate selection of individuals for sport, the quality and effectiveness of the training process and from the whole set of agents which condition these two basic factors, e.g. from coaching personnel, material conditions, social conditions, transfer of scientific knowledge, etc. Sport practice clearly proves that top sports performance may only be reached by an extremely talented individual through the influence of favourable educational conditions. The role of the selection process is to find such individuals from the population who have all the prerequisites to reach the top sports performance level. If we do not pay attention to the selection of children for sport, we decrease the efficiency of the coach's work in the education of perspective top sportsmen. According to Perič, Hošek, Bunc (2002), the requirement for the earliest examination of sportsman possible puts extreme demands on the diagnostic means, e.g. selection of appropriate tests, quality of evaluation – examination of achieved results in respect to the expected performance of a child and minimization of wrong predictions. It means the selection of a child with a small perspective or, vice versa, non-selection of a child with a high perspective. This makes the whole area of talent identification a very complicated activity that requires a high level of expertise.

The level of fitness depends on the age, sex, genetic conditions (especially the adaptation possibilities of an organism), control mechanisms of CNS, mental characteristics (motivation,

emotions, aggressiveness, vitality, temperament, etc.) as well as on the age of beginning and the whole length of completed fitness training (Šimonek, 2003). More sports areas and disciplines put specific requirements on the indicators of physical development, mostly the physical height, which needs to have been already predicted in children during the primary selection for its genetic determination (Siris, Gajdarská, Račev, 1983; Havlíček, 1987). It is necessary to remember that the "value" of preconditions that determine sport talent is not constant; it significantly changes depending on the age of an individual and completed level of training (Moravec, 2007).

Basic sport training at the age of 11- to 14-years standardizes the conditions for the performance of movement abilities and gives the possibility in mutual comparison of pupils to reveal more accurately innate dispositions (Koštial, 1979).

Nowadays, sporting youth is registered either in sport units, sport classes, at eight-years secondary grammar school, or in centres for Olympic preparation. However, we can say that the predominant majority is concentrated in sport units where they can gain their first sports' experience.

Currently, there is no unified selection to the system of sport training for individual types of sports as it was organized in the past. Children enter into the training process either on the recommendation of parents, or they visit the sports club closest to their place of residence. Many talented children do not get into sports training due to the bad economic situation of their family, so they do not have the possibility to show and develop their sporting preconditions. While in the training process there are also less talented children who do not even show an interest in physical activity. Even in this difficult situation the majority of the sports clubs try to carry out the selection of candidates for the primary stage of sports training.

Aim

The aim of the research was to point out the differences in physical development and the level of movement abilities of 11- to 15-year old sportsmen (who underwent the primary selection and completed time variable periods of sport training) and the same age population.

Hypothesis

We have based our research on the assumption that the observed group of young sportsmen will present themselves with a higher level of general fitness performance compared to the same age population.

Methods

The research group consisted of selected 11- to 15-year old sportsmen who were, between the years 2008 to 2010, members of centres of talented youth, sport units, sport classes and sport secondary grammar schools in Slovakia. We conducted a single cross testing of sportsmen of the listed age groups.

We intentionally chose the age of sportsmen to be the same as the age in which young sportsmen enter into sports training and, subsequently, in which comprehensive training prevails over the special one.

Probands were sportsmen with specialization in ice hockey, football, volleyball, basketball, swimming, canoeing, athletics and handball. The group consisted of 610 boys. We measured physical height, physical weight from the indicators of physical development and calculated the body-mass index (BMI). The set of fitness tests consisted of a 50 m run from high starting on the beep, a 12-minutes run, a long jump from a place with reflection and legs together, pull-ups, a throw from a place with a 2 kg full ball, up-downs in a minute and one test with fitness-coordinating saturation – run to targets. Some of the probands did not participate in all examined testes; therefore their numbers in the particular tests differ.

In obtaining and evaluating the research data we used the following methods:

- methods of measurement and testing of physical development and movement performance,
- mathematical-statistical methods, average, standard deviation, parametrical t-test for independent groups,
- logical methods.

We assessed the statistical significance of mean-value differences at 1 % and 5 % of significance level.

Comparison of physical development indicators of 11- to 15-year old sportsmen and the population

In our research we noticed in the group of 11- to 12-year old boy's population and sportsmen nearly the same values in all examined physical indicators, i. e. physical height, physical weight and BMI without statistical significance (table 1). From age 13-years we found the statistical significance at 1 and also 5 % of probability level in physical height, and it was always in favour of the sportsmen. The higher value of physical height and weight to some extent relate to the selection of various somatypes – sportsmen that we were able to test. The value of standard deviation in BMI is always lower in observed classes and in favour of sporting boys. More over, 14-year old sportsmen had even more significant reduction in the value of standard deviation. This shows the importance of physical activity in this critical stage of puberty when a large part of the young population does not show interest in physical activity.

Comparison of the level of general movement performance of 11- year old sportsmen and population

In this age category we noticed (table 2) significant differences at 1 % of statistical significance level in nearly all examined tests in favour of the young sportsmen. The only test where we did not find any statistically significant difference was the test involving pull-ups on the hopping rack. The result did not surprise us because during the testing we found that young sportsmen had the biggest problem with its performance out of the whole range of tests. Many of them only hung on the rack without any sign of pulling themselves up. This test is, in our opinion, for the current generation of children, too difficult to perform. Natural moving activities (sawing wood, carrying loads, arms exercise, climbing up trees, etc.), which would stimulate natural development of muscle power of upper limbs, has

Table 1

Statistical characteristics of significance of average-value differences in physical development indicators of 11- to 15-year old sportsmen and population

Age	Indicator	Name	Number	x	s	t – test	Sign.
11-year old	Physical height [cm]	Population	164	148,9	7,88	1,687	
		Sportsmen	127	150,4	8,97		
	Physical weight [kg]	Population	164	42,36	10,44	0,394	
		Sportsmen	127	41,91	8,47		
	BMI (I)	Population	164	18,97	3,64	1,497	
		Sportsmen	127	18,39	2,71		
12-year old	Physical height [cm]	Population	133	156,0	9,40	0,284	
		Sportsmen	151	155,7	8,31		
	Physical weight [kg]	Population	133	46,05	11,60	0,305	
		Sportsmen	151	46,47	11,47		
	BMI (I)	Population	133	18,75	3,44	0,595	
		Sportsmen	151	18,99	3,33		
13-year old	Physical height [cm]	Population	198	162,1	10,14	**3,218****	$p < 0,01$
		Sportsmen	172	165,4	9,42		
	Physical weight [kg]	Population	198	52,00	13,06	0,917	
		Sportsmen	172	53,13	10,13		
	BMI (I)	Population	198	19,61	3,77	1,030	
		Sportsmen	172	19,27	2,26		
14-year old	Physical height [cm]	Population	117	171,1	7,81	**2,164***	$p < 0,05$
		Sportsmen	105	173,5	8,64		
	Physical weight [kg]	Population	117	59,48	12,90	1,321	
		Sportsmen	105	61,45	8,52		
	BMI (I)	Population	117	20,16	3,33	0,515	
		Sportsmen	105	20,35	1,85		
15-year old	Physical height [cm]	Population	195	174,1	7,43	**3,052****	$p < 0,01$
		Sportsmen	55	177,6	7,66		
	Physical weight [kg]	Population	195	63,21	12,19	**2,052****	$p < 0,05$
		Sportsmen	55	66,86	9,22		
	BMI (I)	Population	195	20,78	3,48	0,671	
		Sportsmen	55	21,11	1,95		

disappeared from life. It also proves that sport training at this age does not provide sufficient incentives, which would ensure differences in the performance of the population and sportsmen. In other tests, a higher level of sportsmen's performance was shown, which was caused by an accumulation of many important factors. Yet, by greater frequency of sport training, more comprehensive moving activities, acquired moving abilities, higher participation in sports activities at a younger school age and, last but not least, also by possible higher motivation in some tests, which are "painful".

Table 2

Statistical characteristics of significance of average value differences in the movement performance of 11–year old sportsmen and population

Age	Test	Group	Number	x	s	t – test	Sign.
11-year old	Long jump from place [cm]	Population	163	151,3	22,58	**6,198****	p < 0,01
		Sportsmen	126	167,2	20,14		
	Up – downs	Population	163	35,28	9,77	**6,032****	p < 0,01
		Sportsmen	90	42,83	8,97		
	50 m run [s]	Population	161	9,53	0,93	**4,348****	p < 0,01
		Sportsmen	53	8,93	0,64		
	12 min, run [m]	Population	163	1909,5	365,0	**9,173****	p < 0,01
		Sportsmen	84	2340,1	312,7		
	Pull – ups	Population	155	2,26	4,73	0,435	
		Sportsmen	76	2,01	2,25		
	Throw with full ball [m]	Population	163	418,6	86,4	**6,140****	p < 0,01
		Sportsmen	112	485,1	90,1		
	Run to targets [s]	Population	163	10,60	3,56	**4,284****	p < 0,01
		Sportsmen	78	8,84	0,89		

Comparison of the movement performance level of 12-year old sportsmen and population

By comparison of motor performance in this age group we can state a similar process as it was in the group of one-year younger sportsmen. In the group of probands we found in six out of seven tests (table 3) a higher level of performance at 1 % of statistical performance level when compared to the population. Also, we did not notice any significant differences in the pull-ups test as were in the previous age category. Moreover, these sportsmen had an average level of performance even lower than their peers and sportsmen from the one-year younger age category. We do not know exactly what causes this low level of performance. We did not notice any statistically significant differences in physical indicators, which could influence the results – positively or negatively in one of the movement tests. Both groups had nearly the same values and also standard deviation in these indicators.

Table 3

Statistical characteristics of significance of average value differences in moving performance of 12 – year old sportsmen and population

Age	Test	Group	Number	x	s	t – test	Sign.
12-year old	Long jump from place [cm]	Population	133	159,2	23,66	**5,979****	p < 0,01
		Sportsmen	147	176,1	23,42		
	Up – downs	Population	133	36,90	9,43	**5,933****	p < 0,01
		Sportsmen	86	45,49	11,78		
	50 m run [s]	Population	131	9,14	1,04	**3,412****	p < 0,01
		Sportsmen	38	8,53	0,64		
	12 min, run [m]	Population	130	2081,5	426,3	**3,794****	p < 0,01
		Sportsmen	77	2296,0	323,4		
	Pull-ups	Population	127	2,08	2,61	1,284	
		Sportsmen	66	1,61	1,93		
	Throw with full ball [m]	Population	131	484,7	105,2	**5,336****	p < 0,01
		Sportsmen	127	556,5	110,1		
	Run to targets [s]	Population	130	9,63	2,76	**3,050****	p < 0,01
		Sportsmen	70	8,60	0,73		

Comparison of movement performance level of 13-year old sportsmen and population

Comparison of the performance of sportsmen and population in this age category had a similar character to previous years. Sportsmen again recorded a statistical significance of differences at 1 % and 5 % of statistical significance level in all tests, aside from the pull-ups (table 4). During analysis of somatic indicator gains we found that sportsmen had higher gains in physical heights between the ages of 12 and 13 than the population (9,7 or 5,9 cm). This difference together with training stimulus (better coordination of movement) could also cause higher gains in two disciplines with an ”explosive“ character, in the long jump with legs together and throwing a full ball. We also found that sportsmen in the test of up – downs were slightly worse in average performance when compared to the younger sportsmen (45,49 or 44,48 repeats). We explain this in a way that higher gains of physical height could cause more unfavourable conditions for the realization of this test. In a 12-minutes run, compared to the group of one year younger sportsmen, we noticed a decrease of performance – they did not even reach the performance level of 11-year olds.

Table 4

Statistical characteristics of significance of average value differences in movement performance of 13–year old sportsmen and population

Age	Test	Group	Number	x	s	t – test	Sign,
13-year old	Long jump from place [cm]	Population	200	170,7	24,63	**9,422****	p < 0,01
		Sportsmen	170	194,0	22,42		
	Up - downs	Population	199	36,96	10,66	**5,449****	p < 0,01
		Sportsmen	71	44,58	8,23		
	50 m run [s]	Population	186	8,82	1,15	**4,125****	p < 0,01
		Sportsmen	65	8,20	0,62		
	12 min, run [m]	Population	197	2061,1	444,5	**4,502****	p < 0,01
		Sportsmen	72	2317,7	307,4		
	Pull-ups	Population	186	2,00	2,79	1,800	
		Sportsmen	65	2,78	3,52		
	Throw with full ball [m]	Population	198	574,2	139,6	**9,811****	p < 0,01
		Sportsmen	165	725,2	152,5		
	Run to targets [s]	Population	198	9,09	2,34	**3,160****	p < 0,01
		Sportsmen	65	8,15	0,84		

Comparison of movement performance level of 14-year old sportsmen and population

In comparing the groups of sportsmen and the population (table 5), we found the same results as in the previous age categories. Average performance in all tests was statistically significant at 1% of significance level with the exemption of the pull-ups test. Also, the differences in average performances were stronger, e. g. in the 50m run there was a half-second difference (8,23 or 7,68 s), one and half – second run to targets (9,43 and 7,84 s) in favour of sportsmen. In tests where the result is influenced by the volition characteristics of probands, the ability of trained persons to overcome unpleasant conditions was demonstrated only in endurance running. We noticed a difference of 431,8 m (2,137, or 2,568 m). In up – downs test, despite the statistically significant difference, the number of repeats (42 and 47) was not very different.

Comparison of movement performance level of 15-year old sportsmen and population

During the comparison of performance in the individual test we recorded statistical differences at level p < 0,01 in favour of the sportsmen group, except in the pull-ups test (table 6). The biggest difference of performance was in throwing with a full ball (196 cm) and in the long jump from place (31,2 cm). In the 12-minutes run the difference decreased between groups (315,7 m). In this age category we also noticed a higher homogeneity of the sportsmen group.

Table 5

Statistical characteristics of significance of average value differences in movement performance of 14 –year old sportsmen and population

Age	Test	Group	Number	x	s	t – test	Sign,
14-year old	Long jump from place [cm]	Population	116	189,0	22,95	**7,430****	p < 0,01
		Sportsmen	103	211,8	22,12		
	Up – downs	Population	116	42,66	10,18	**3,834****	p < 0,01
		Sportsmen	72	47,78	6,14		
	50 m run [s]	Population	115	8,23	1,06	**4,151****	p < 0,01
		Sportsmen	72	7,68	0,45		
	12 min, run [m]	Population	115	2137,0	435,3	**7,528****	p < 0,01
		Sportsmen	72	2568,8	267,7		
	Pull-ups	Population	115	2,68	2,69	1,662	
		Sportsmen	72	3,40	3,13		
	Throw with full ball [m]	Population	116	689,8	129,3	**7,887****	p < 0,01
		Sportsmen	105	827,8	129,3		
	Run to targets [s]	Population	114	9,43	2,48	**5,294****	p < 0,01
		Sportsmen	72	7,84	0,66		

Table 6

Statistical characteristics of significance of average value differences in movement performance of 15–year old sportsmen and population

Age	Test	Group	Number	x	s	t – test	Sign.
15-year old	Long jump from place [cm]	Population	195	191,7	30,20	**7,747****	p < 0,01
		Sportsmen	56	224,9	19,41		
	Up – downs	Population	195	42,79	9,75	**4,520****	p < 0,01
		Sportsmen	27	51,78	8,82		
	50 m run [s]	Population	177	8,34	0,90	**4,952****	p < 0,01
		Sportsmen	27	7,46	0,52		
	12 min. run [m]	Population	194	2153,6	386,8	**4,041****	p < 0,01
		Sportsmen	27	2469,3	313,4		
	Pull-ups	Population	178	6,50	5,70	0,147	
		Sportsmen	27	6,33	4,54		
	Throw with full ball [m]	Population	195	747,6	157,8	**8,558****	p < 0,01
		Sportsmen	56	951,0	150,2		
	Run to targets [s]	Population	195	8,94	2,21	**3,738****	p < 0,01
		Sportsmen	27	7,33	0,76		

Conclusion

1. We did not notice any statistical differences in somatic indicators between groups of 11- and 12-year olds, nor in the group of 13- to 14-year olds, except in physical height. We found difference in parameters (PH, PW) only in the oldest group of 15-year olds. Noteworthy is the fact that in none of the groups were there any statistically significant differences in the BMI index.

2. In nearly all tests of general movement performance we found a progressive increase, from the lowest age category to the highest. The exception to this trend was the pull-ups test, which seems to be an inappropriate test for both sportsmen and population.

3. In groups of older sportsmen, in comparison to population, more significant average value differences were shown in the test, which required a higher level of coordination and a quick change of movement tasks (run to targets).

4. We recorded a fluctuating character of performance in endurance running. We assume that the results in this test could have been influenced by motivation, ability to overcome unfavourable feelings, or also previous training and competition program. In spite of this, the sportsmen always achieved better results than population in all categories. Based on our results we reached the conclusion that for some specializations (hockey, basketball, football, futsal, handball) an endurance shuttle run is more appropriate than a continual 12 minutes run.

5. The biggest problem for probands was the pull-ups test on hopping rack. In none of the categories did we notice more significant average performance (2 – 3 pull-ups in lower age categories, in the oldest category the average performance was 6,3 pull-ups). Due to the big standard deviation we could not practically assess the test. This test pointed out the inefficient power training of young sportsmen, because the results of population were better in nearly all age groups.

References

1. HAVLÍČEK, I. 1982. *Vedecké základy športovej prípravy mládeže*. Zborník VMR SÚV ČSZTV IX. Bratislava : Šport, 1982. 340 s.
2. HAVLÍČEK, I. et al. 1987. *Športová príprava talentovanej mládeže*. Zborník VMR SÚV ČSZTV. Bratislava : Šport, 1987. 325 s.
3. KOŠTIAL, J. 1979. Model dlhodobej športovej prípravy mládeže v prekážkovom behu. In Kuchen, A.: *Športová príprava mládeže*. Zborník VMR SÚV ČSZTV VI. Bratislava : Šport, 1979, s. 161-188.
4. KUCHEN, A.: *Športová príprava mládeže*. Zborník VMR SÚV ČSZTV VI. Bratislava : Šport, 1979. 244 s. 77-037-79
5. KUCHEN, A. et al. 1981. *Východiská pre výber a rozvoj talentov v športe.* Zborník VMR SÚV ČSZTV VIII. Bratislava : Šport, 1981. 233 s. 77-044-81
6. MORAVEC, R. 2007. Metodika výberu talentov pre šport. In Kolektív *Výber talentovanej mládeže pre šport*. Prešov : 2007, s. 5-8.
7. SIRIS, P. E., GAJDARSKÁ, P. M., RAČEV, K. I. 1983. *Otbor i prognozirovanie sposobnostej v legkoj atletike*. Moskva : FiS, 1983.
8. PERIČ, T., HOŠEK, V., BUNC, V. 2002. Základy výběru talentů. In Dovalil, J. et al.: *Výkon a trénink ve sportu*. Praha : Olympia, 2002, s. 278-290.

9. ŠIMONEK, J. 2003. Kondičná príprava, kondícia, pohybový potenciál športovca. In Sedláček, J. et al. *Kondičná atletická príprava a rekreačná atletika*. Bratislava : Univerzita Komenského, 2003, s. 7-10. ISBN 978-80-223-2288-1

RESUMÉ

VPLYV ŠPORTOVEJ PRÍPRAVY NA ÚROVEŇ ROZVOJA KONDIČNÝCH SCHOPNOSTÍ 11- AŽ 15-ROČNÝCH CHLAPCOV

Ladislava Doležajová – Anton Lednický

Autori sledovali somatické ukazovatele mladých športovcov a populácie. Nezaznamenali výrazné štatistické rozdiely Za pozornosť stojí fakt, že ani v jednej skupine a ani v jednej vekovej kategórii nebol zaznamenaný štatisticky významný rozdiel v indexe BMI. V testoch všeobecnej pohybovej výkonnosti zistili jej postupný nárast, a to od najnižšej vekovej kategórie k najvyššej. Výnimkou v tomto trende bol test zhyby, ktorý sa javí ako nevhodný pre športovcov ako aj pre populáciu. Výraznejšie rozdiely priemerných hodnôt sa prejavili v teste, ktorý vyžadoval vyšší stupeň koordinácie a rýchleho striedania pohybových úloh (beh k métam). Kolísavý charakter výkonnosti bol vo vytrvalostnom behu. Na výsledky mohli mať veľký vplyv motivácia, schopnosť prekonávať nepriaznivé pocity, ale aj predchádzajúci tréningový a súťažný program. Najproblémovejším bol test zhyby na doskočnej hrazde. Ani v jednej vekovej kategórii autori nezaznamenali výraznejší priemerný výkon. Vzhľadom na veľkú smerodajnú odchýlku ho nebolo možné prakticky hodnotiť. Tento test upozornil na nedostatočnú silovú prípravu mladých športovcov, pretože výsledky populácie boli takmer vo všetkých vekových skupinách lepšie.

THE ASPECTS OF MEANING OF THE RELATION BETWEEN CORPORALITY AND EROTICA IN SPORT

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Summary: The article analyzes interrelations between sport and erotica. It rejects the propagation of sex through sport and the propagation of sport through sex. Author asks the question whether the erotica is a phenomenon that forms values of recent sport or it is only its epiphenomenona. The relation between corporality, sport and erotica could be discussed from various aspects such as aesthetical, ethical or philosophical. This relation also includes psychological, sociological, denominational, sexological, gender and commercial aspects. We can say beforehand that the esthetical aspect is dominant aspect of the topic. Eroticism and beauty are important categories of aesthetics. The eroticism of sport, which is derived from the corporality of athletes and based only on corporality, is identified by sensuality (and sensuousness) of human body. The naked body expressing the dynamics of some sport act shows this dynamics authentically and truthfully. Erotica in sport, its various forms that follow the rules and aesthetical spirit of sport and are also acceptable by taste of athletes or spectators, is considered as a cultural and sport artefact.

Key words: Corporality, sport, erotica, categories of aesthetics, beauty, and sensuality.

Introduction

The aim of consideration the sport and erotica associations is the analysis of the interrelation between characteristics of human body and important phenomena of our lives. Therefore it is not the propagation of sex through sport and the propagation of sport through sex. Another aim of this work is to ask the questions whether the erotica is a value shaping a phenomenon of recent sport or it is only its epiphenomenon. In other words, it is only the accompanying phenomenon of sport in particular time connections. This epiphenomenon is a secondary phenomenon accompanying some thing or process, which basically do not influence the given thing or process by its presence or absence. The last aim of this work is to find the answer to the question – what are the causes of intersection of erotica and sport and causes of searching for erotica by sport itself? This is very important question, because when we know the causes of some phenomenon, affair or action, we can foresee the consequences of the phenomenon. Sport, or another related sciences, will seriously start to deal with the interrelation between sport and erotica only if it is evident that erotica influences sport performances. Nowadays, this influence is only on speculated level or is talked about unofficially.

The basic aspects of "sport and erotica" topic

We believe that the topic "corporality, sport and erotica" could be discussed from various aspects: esthetical, ethical, philosophical, psychological, sociological, denominational, sexology, gender, commercial anthropological and others. In this paper we shall discuss very briefly only three aspects of "corporality, sport and erotica" topic, which we consider as fundamental.

Before the analysis of basic aspects between the key terms of our article we will explain the content of them. We suppose that the body problems, corporality and sport are well developed with current and past adequate theory. Therefore we will not state their draft terms. In case of word erotica we consider the explanation, scientifically useful. The Anthropological dictionary derives erotica from the Greek term „erós" (desire, love, passion, favour). We will base our reflection paper (term "erotica") on translations and monolingual dictionaries. Erotica is there defined as such phenomenon, which is related to sexual activity, feeling, experiences and "sex" love. Erotica is a spiritual (!) dimension of sexuality; sublimation of sensuality cultivated by culture and at the same time erotica is the source of inspiration, which has the basic field in art (Malina et al., 2009, p. 75). There must be stated basic anthropological paradigm, which says, that "we can not understand the man if we do not understand the body. The man is one's own body, the man is expressed by its own body" (Hodaň, 2009, p. 75). In sport field this paradigm is valid without any restriction. Terms such as corporality, bodily, embody are derived from the term body. The corporality and linked culture of movements tell about feelings, desires, moods and character of man.

Aesthetical aspect

We can say beforehand that this is a dominant aspect of the topic from several points of view. Eroticism and beauty are important categories of aesthetics. The beauty could be characterized as harmony, symmetry, complexity and impressiveness of something, which should form a whole. Beauty and eroticism – each of them has its own and different idea. "Erotic and aesthetic mean two things; if we want to assimilate them, it means we do not want to understand the nature of them" (Vaněk, 1999, p. 85). Eroticism (we use this term as an aesthetical equivalent and modification of erotica) and beauty are important values of many human activities and belong to sport by nature, whether we look at the problem from a historical or current point of view. In the creative and undistorted perception of a sport event, sport action and athletic body, each of them is understood as part of the other, but not as a condition of the other. If the modern sport is able to stimulate somebody aesthetically, it is also more or less able to stimulate also erotically.

Speaking about beauty in sports and erotica is often associated with the corporality of sport, which means with the body, shapes, movements and gestures of an athlete. This is a right imagination in principle, but not complete. It is created on the base of an initial impulse, most often it is visual perception. However, the process of perception does not cease here. According to Michelangelo, the man first perceives "the visible beauty, but from this beauty the soul uplifts to the beauty itself. By force of visible beauty the man perceives the pure, divine, immortal beauty" (In Tatarkiewicz, 1999, p. 135). In other words, firstly, it is important for the eye to be steeped in beauty and eroticism and thus the hedonistic need of human can be satisfied at the same time.

Ethos, the spirit of sport, helps with its aesthetical and erotic expressions of sport. If we can divide the beauty of sport into sensual and spiritual, we can divide the erotica into sensual and spiritual, as well. In this context Jirásek used an excellent aesthetical terms. "Elegance and grace, harmony, rhythm, the purity of movement, individual creativity and interpretation, are the values which underline the kinetic art" (Jirásek, 2009, p. 17). The art of sport and erotica establish relations which inspire the intelligent creator of artistic, sports and erotic values, but do not scandalize the creator. Also, the first people, Adam and Eve, were represented in "erotic clothes".

Eroticism of sport derives from the corporality of athletes and it is identified with sensuality (and sensuousness) of the human body. Vulgar and aggressive erotica is in today's sport promoted by nudity, which make the sensual ideas change into sexual ones. However, we do not accept this development of sport. If we work on one of the possible sexual definition, than we certify, that instigation of sexual ideas do not belong to sport. Sexuality (from Latin: sexus, „gender") is term used for the way of having an opinion of, understanding of and organising of sexual behaviour and desires of society. Sexuality could be defined on individual level as an understanding of own erotica and emotional needs and desires, as a consequence of sexual behaviour of individual. Or could be defined on collective level as a mechanism organisation and regulation of erotic relationships and behaviours between members of some community" (Sokolová, in Malina et al., 2009, p. 3565). Such erotic on the sport field, which coincidence with stated definition of sexuality, we consider as vulgar, inappropriate even irrelevant in relation to sport.

Naked and exposed body (which is the case of sport and athletes) can very often express more than covered body (Picture 1). Naked body expressing the dynamics of some sport act shows this dynamics authentically and truthfully. Sport clothes have their aesthetical aspect and are also advantageous from the technical and methodological points of view. For example, the coach of a high jumper can interpret the movement and find technical mistakes of an athlete easier if he/she can see the particular areas of the body as authentically as possible. The exposure of the athlete's body is one of the possibilities of catching attention to the impressiveness of sport performance.

Picture 1
Covered body

The covered body has a note of erotic too. Erotica has a plenty of forms and is always connected to the current cultural climate, ethnicity, traditions in the way of thinking and dressing. Very often it is conditioned by religious culture. As one can see in Picture 1 there are three women which represent traditions before inclination to erotica. In these clothes they cannot flourish like a green bay tree any sport discipline, or anything related to sport.

When speaking about the process of gradual exposure of athletes, we find the first experiences in the ancient times. It is known that then athletes used to engage in some sports disciplines completely naked. However, in those times the nudity was perceived in a different way. Several years ago we did a case study, which involved an athlete, a runner to be exact. We chose such an area where we did not expect any undesired audience. With our "experiment" we did not want to elicit unwanted curiosity, voyeurism or moral shock of accidental spectators. The athlete ran approximately 2 km only in shoes, without any clothes. The thesis about matching the human being to Earth was inspiring idea of this experiment. The idea is also about the same basis of natural and human nature. The thesis was not verified as correct. The subjective feelings arisen from the run of naked man were not pleasant, which resulted also in unpleasant perception of sport performance. Taking into consideration the movements of penis, the feelings were troublesome. The result of this case study (easy experiment) was quite banal, irrelevant but true. This sport discipline (and we suppose that each sport discipline) requires appropriate and, nowadays also, scientifically tested clothes. The aesthetical and ethical needs of the athlete do not play the main role; despite of they are important, but objectively tested and validated principles and norms, which determine the character of sportswear garments. If happens that an athlete is driven by erotic needs while choosing the sports garments, it means that he or she satisfies the need of exhibition.

However there is difference between motives of our acting and our taste comparing them to perceiving the acts of our acting and expressing of our taste (Picture 2).

Picture 2

The touch of erotica in sports dress

Erotica exists in sport only in the case that its existence is perceived by a spectator or any other protagonist of sport. The world out of the subject exists only if it is perceived by this subject.

The forms of erotica in sport which follow the rules and aesthetical spirit of sport and which are also acceptable by athletes' and spectators' taste are considered as a cultural sport artefact. Comparing it to biological or sexual sexism we can only speak about simple "natural" instinctive or commercial matter of course.

An important term for aesthetical thinking and aesthetical relation is taste. The gentle and only indicative form of erotica in sport must not be an offence to taste. "In aesthetical relation of beauty we take into consideration nobleness, too" (Vaněk, 1999, p. 85). Vulgar, obtrusive and vacuous eroticism in sport is an offence to taste, because there is no nobleness that was mentioned before.

Ethical aspect

The ethics is part of sport. We can say that the ethical aspect is one of the most discussed topics in sport, even outside this field. Huizinga, while analyzing the game in social culture, critically notes that sport is distancing from culture. "Sport has been completely profaned and does not relate to the structure of society organically, even if the performance is ordered by government. It is more an independent display of agonal instincts than a worthwhile factor for society" (Huizinga, 1990, p. 353). Whenever we talk about "unifying" sport and erotica, we do it only in private, in unofficial discussions, never at a convention or in other open forum.

The ethical aspect is another very important element of the analysis of the relationships between sport, corporality and erotica. We also mention the plurality of ethical attitudes to this topic regarding the plurality of ethical concepts, which are based on these attitudes. The spectrum of these attitudes begins with uncritical acceptance. Then comes indifference to this matter and ends up with *a priori* rejection of any erotica and cult of the body in sport.

The primal expression of ethical understanding of this topic is making it taboo. Sport by itself was to some time in the past considered as immoral and did not have any support of society. However, making taboo of any existing topic is hypocrisy. Pretending that there is no relation between sport and erotica is an example of such hypocrisy. In this context we dare make an analogy. Freud describes the way of understanding the child sexuality in his times and the medicine point of view on the issue. Allowing the existence of this sexuality meant "the attack on one of the strongest human prejudices". The childhood should be "innocent", without any sexual desires. If people noticed the manifestations of children's carnality, they would consider them signs of degeneration, corruptness or freaks of nature (Freud, 1990, p. 28). Here is a brief comment to Freud's topic. We believe that if Freud was right, than erotica in form of sexual instinct, also influence sport in authentic and subconscious way, and through the cultural „filter".

An interesting form of ethical aspect of the relationship between sport and erotica is sport arriviste. In a terminological dictionary the sport arriviste (German *Arrivierte*) is defined as an unhealthy ambition, arrogance, careerism, frantic effort to stand out from society, uncontrolled effort to become number one in a sport team, or some sport discipline, over-ambitiousness, a will to succeed. Sport arriviste has, therefore, signs of some over-blown, extremely strong desire to win no matter what; it shows signs of over-competitiveness, some unhealthy desire to distinguish oneself and to be the best, even if it means using unfair practices, tools, or breaking fair play rules. One of these "forbidden" practices is erotic propagation of corporality values and sensuality of the athlete (Oborný, 2007, p.

204). The forms of propagation of corporality are mainly the body language gestures and its nakedness.

The nakedness is "an exciter" for moralists and puritans. Therefore, they denounce it roundly. The erotic side of sport and erotic correlations always brings the potency of provocation. The provocation itself is not immoral, it is obviously morally indifferent. However, if the provocation concentrates on the ethical feelings of some group of spectators purposefully, the ethical value becomes very disputable. We can say that in sport the nakedness is considered as form of the exposure of the body, its parts, proportions, force, but not a form of sports "artistic" act or pornography at all. Not every manifestation of nakedness is perceived as a manifestation of sexuality. "It is not necessary to perceive the nakedness under the terms of sexuality. It is not the nakedness that is a question of morality, but imagination which is aiming at sexual levels of nakedness" (Jirásek, 2009. p. 11). The exposure of athlete's bodies (male and female) should contribute to the understanding of the beauty and spirit of sport, the beauty and soulfulness of human. The body and its gestures with a touch of eroticism can be understood as a means of communication between the athlete and the spectator and with other co-actors of a sport event (*Picture. 3*). Probably there is some specific self-satisfaction in athletes, while exposing themselves in front of spectators. Such self-satisfaction is gladly accepted as a variegation of participation in sport events. We do not support such an exposure, which may be understood as a public aphrodisiac for spectators at all. If it excites the person in audience sexually, it is not the consequence of sport expression, but the consequence of a desire of the spectator.

Figure 3

Erotic communication between sportswomen and spectators.

The Picture 3 could be presented without saying a word, but here is a short comment to understand why it is inserted. What we see is a celebration of sensual beauty of the human body, it is a form of creative searching how to increase the attractiveness of sport, but it is not the celebration of sport itself.

The issue of the nakedness of the body, eroticism and sensuality has a gender modification from the ethical point of view. The gender perception of a given topic is subordinated to the culture of a given society. Many societies consider themselves modern and progressive in the full sense of these words, although, in reality, prejudice prevails and stereotypes dominate in many of modern societies. The woman's and man's norms are applied at the level of erotica and sport to judge what is not right, because it is immoral, provocative, tempting and aimed against traditional values. Straková pointed out this problem in general (2009, p. 407 – 408). "In our society it is not appropriate even nowadays to satisfy the woman's needs independently, or to treat them as a part of her personality without any sense of guilt. The autonomous female sexuality is still, in our society, connected to the terms like shamelessness, unsoundness, or immorality and, in extreme cases, evokes the sense of guilt among girls and women." We can compare it to the analysis of the term shyness made by Max Scheler in 1923. According to him, shyness can be divided into two different forms: "physical shyness, in other words, the vital shame where the sexual shyness is only the strongest vital shyness ..., the other one is spiritual shyness, in other words, spiritual shame.... Both forms are used only when "I" defend myself from the whole sphere of general" (Scheler, 1993, s. 85). For that matter, the human being, woman or man, can feel shyness also in the case when acting in accordance with morality, i. e. possibly not acting against the content and moral norms.

The protagonists of today's sport are people of different age and health. Children and seniors, able and disabled, all of them engage in sport. The sport and erotica relation has in every specific moment its moral form. We believe that this relation of sport and erotica is relevant only (or mainly) for sport of adults and young people, not handicapped, generally for responsible sport persons, both women and men. Exactly and rigorously said, sport and erotic cultural forms are only admitted in the sport of adults. These reasons lead us to think that erotica in sport is inadmissible for children and adolescents from the moral and legal points of view; the infiltration of erotica to sport could be perceived as an instigation of paedophilia and would be the flagrant threat to moral development of young athletes.

The sport and erotica relation is suitable mainly for young athletes to form the aesthetical and ethical perspectives. The erotica is natural for adolescents as it regards their personal and inner needs, as well as the need of external communication. With all respect to seniors sport, the erotic symbols would be here distasteful, offensive, comical, what is more, they could exhort to gerontophilia.

Philosophical aspect

At the end of our paper we describe several possible philosophical views on erotica and sport relations. Mainly we think that "erotic" is subjective. The same thing, every person perceives the same behaviour in different erotic ways. Our optical system is "adjusted" individually. The same happens to our erotic perception. If we want to see something in a given thing, we mainly have to want to see it. The dimension and quality of erotica in sport, to some extent, depends on the individual. If we want to understand each other, we have to be empathic quite enough.

Erotic is also objective, otherwise there will not *de facto* be the reasons to discuss it. It is obvious that erotica exists in sport; what we do not know is what it actually is, how it is identified, what the real expressions of it are. Sport is a cultural activity in which there are strict and exact rules, as well as cultural norms as a result of process of humanization. „The sphere of modern sport therefore absorbed the spectrum of original anthropologic elements (competition, aggression, tendency to dominate and to win) in authentic link to emotional and spiritual states, which provided accompaniment for realisation of living potency of human during whole period of cultural development" (Nemec, 2010, p. 37). Sport has a system character, therefore, the same strict and exact rules should be valid also in its subsystems. We cannot determine the rules of tolerable existence of erotica in sport with a scientific consistency. In spite of that, we believe there are given "common" criteria of eroticism in sport, mainly as a social convention. The contemporary sport is a proof that these (unwritten) criteria are respected.

The word erotica derives from the name Eros. According to the original ancient Greek mythology, and as it is well known, it was the name of the god of love who has a dignified position in mythology. Gods were not born at the same time, but they came into being one after another. "For the Greeks, Chaos was the first god, followed by Earth or Gaia, while Eros came third" (Hošek, 1972, p. 115). Hand in hand with the topic of sport and erotica goes the topic of sport and love. Not for this reason we returned to the ancient times. Making use of the knowledge of these times, we want to point to the creative power of erotica. Each god represents some principles. From the very beginning Eros had creative and eternal power. According to the ancient Greeks' ideas the eternal life for gods was only guaranteed when they came into the world and when they deserved immortality. According to Plato's ideas, which are presented in the dialogues included in the Symposium, Eros leads the human soul from the desire of beautiful bodies to the desire of spiritual beauty. He uplifts this beauty up to the cognition of the idea of beauty (Platón, 1990, p. 707-708).

Conclusion

We must distinguish three main forms of intersection of erotica with sport. In the first case, the erotica in sport arises as a natural but unplanned product of sport; it arises spontaneously. In the second case we reflect the moment of erotica in sport as a consequence created by an unexpected situation (the simplest example could be a defect of an athlete's garment). The phenomenon of erotica in sport appears in sport naturally or as a product of doing a sport purposely. The basic reason consists in the animal and social substance and natural character. We understand the moments of erotica in sport as a result of a satisfied need of seeing, feeling and experiencing the eroticism in sport. Not everybody has this ability. *Esse est percipi* – to be is to be perceived. Erotica occurs in sport only under the condition that a spectator or any other protagonist of sport perceives its existence. The world outside of the subject exists only if this subject perceives it.

References

1. FREUD, S. 1990. *O člověku a kultuře*. Praha : Odeon, 1990. ISBN 80-207-0109-5
2. HODAŇ, B. 2009. *K problému filozofické kinantropologie*. Olomouc : Univerzita Palackého, 2009. ISBN 978-80-244-2436-1

3. HOŠEK, R. 1972. *Země bohů a lidí.* Pohledy do řeckého dávnověku. Praha : Svoboda, 1972. ISBN neuvedené
4. HUIZINGA, J. 1995. Homo ludens. In Jeseň stredoveku. *Homo ludens* /The Waning of the Middle Eges/. Bratislava : Tatran, 1995. ISBN 80-222-0211-8
5. JIRÁSEK, I. 2009. Nahota v kontextu pohybové kultury. In *Tělesná kultura*, sv. 32, č. 2, 2009, s. 9-20. ISSN 1211-6521
6. MALINA, J. a kol. 2009. *Antropologický slovník aneb co by mohl o člověku vědět každý člověk.* Brno : Akademické nakladatelství CERM, 2009. ISBN 978-80-7204-560-0
7. NEMEC, M. 2010. Agonistika či šport? Náčrt historicko-filozofických súvislostí. In *Telesná výchova & šport*. Ročník XX, Nº2/2010. ISSN 1335-2245
8. OBORNÝ, J. 2007. Arivizmus (encyklopedické heslo). In KASA, J., ŠVEC, Š. Eds.. 2007. *Terminologický slovník vied o športe*. Bratislava : Univerzita Komenského, Fakulta telesnej výchovy a športu, 2007. ISBN 978-80-89197-78-1
9. PLATON 1990. *Dialógy* I. Bratislava : Tatran, 1990. ISBN 80-222-0125-1
10. SCHELER, M. 1993. *O studu*. Praha : Mladá fronta, 1993. ISBN 80-204-0354-X
11. STRAKOVA, M. 2009. K stereotypizácii ženskej sexuality - vyvlastnená sexualita, vyvlastnené ženstvo. In MARKOVA, D. Ed.. 2009. *Sexualities II*. : Collection of Papers From the Second International Conference held on 30 Sept. – 1 Oct. 2008, ss. 407-413. Nitra : UKF, 477 p. ISBN 978-80-8094-555-8
12. TATARKIEWICZ, V. 1991. Dejiny estetiky III. *Novoveká estetika*. Bratislava : Tatran, 1991. ISBN 80-222-0186-3
13. VANĚK, J. 1999. *Estetika myslenia a tela*. Bratislava : IRIS, 1999. ISBN 80-88778-80-8

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RESUMÉ

VÝZNAMOVÉ ASPEKTY VZŤAHU TELESNOSTI A EROTIKY V ŠPORTE

Josef Oborný

Článok analyzuje súvislosti športu a erotiky. Odmieta propagáciu sexu prostredníctvom športu a propagáciu športu prostredníctvom sexu. Kladie otázku, či je erotika hodnototvorným fenoménom súčasného športu, alebo je iba jeho epifenoménom. Vzťah telesnosti, športu a erotiky sa rieši z estetického, etického a filozofického aspektu. Tento vzťah však obsahuje aj psychologický, sociologický, konfesionálny, sexuologický, rodový a komerčný aspekt. Estetický aspekt je dominantné hľadisko témy. Erotika a krása sú významné kategórie estetiky. Erotickosť športu, ktorá sa odvodzuje od telesnosti športovcov a je založená iba na nej, sa identifikuje so zmyslovosťou (a zmyselnosťou) ľudského tela. Odhalené telo vyjadrujúce dynamiku určitého športového deja vystihne túto dynamiku autenticky a pravdivo. Erotiku v športe, všetky jej kultivované podoby podriadené pravidlám športu a estetickému duchu športovania, vkusu športovcov a divákov považuje článok za kultúrny športový artefakt.

DIFFERENCES IN OPINIONS TO SELECTED QUALITY OF LIFE INDICATORS BETWEEN ELDERLY MEN AND WOMEN

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Summary: Quality of life should express complex subjective and dynamically changing status of the individual. Quality of life evaluation, its different indicators we realized by questionnaire SQUALA. 102 respondents (35 men and 67 women) aged over 60 years participated in our research. Results were differentiated by gender. Both genders together assessed 'health' as the most important indicator in their life and on the other side 'sexual life' and 'politics' as the most unimportant quality of life indicators. We registered statistically significant differences in domain of 'social relations'. In comparison, for women, children, relatives and friends are much more important than for men. Similarly domain 'physical health' means more for elderly women than for elderly men as well as domain 'religion'. Participation in sport and exercise is not very important quality of life indicator for elderly people.

Key words: quality of life domains and indicators, men, women, elderly people.

Introduction

Demographic aging is historically nonreturnable phenomenon that leads to fundamental change of age structures of population in developed countries. It is not only an increased number of seniors but first of all their living conditions. Nowadays by seniors there is increased subjective health assessment significance and the quality of life (QOL) is considered to be more important and more appropriate health indicator than morbidity and mortality (Payne, 2005). Seniors are forced to equalize, more or less successfully, with losses significant for them, with worsening health status, often without possibility of its improvement. In spite of that it is possible to maintain high QOL in older age, potentially up to death (Farský et al., 2007).

In geriatrics and gerontology the QOL is one of the most significant indicators but for comparison with physiological functions it is more difficult to measure it. For seniors it is not enough just to assess the health status, although the importance of the health quality is significantly related and affects the QOL but they cannot be identified. The whole QOL concept is wider and consists of different domains that affect the QOL of each individual at different level (Adamík et al., 2007; Gurková, Žiaková, 2009; Tobišková, Jarošová, 2009).

The QOL is in its character multidimensional concept that includes different aspects of the life reality reflexion. These realities can have for different people different meaning as well as the level of importance. To study QOL issues the following questions appear: are

only objective measured factors and indicators and its difference important or according to subjective character of reflexion of objective conditions is it also necessary to consider its semantic and value aspects at the level of an individual, group or community (Dingová, Nemčeková, 2008). The next possible point of view to answer is the question of individual needs, the level of satisfaction or dissatisfaction (Nemčeková et al., 2000).

The QOL according to elderly people is also affected by achieved level of physical fitness. Seniors are hardly aware of this fact mainly in connection with increased fall risk incidence that is very typical for elderly people (Nemček, 2009). In these cases play an important role regular participation in an appropriate exercise and physical activity (Bendíková, 2010). These activities positively affect biological age, functional variables and content of leisure – time activities (Bunc, Štilec, 2007). In general we can say that healthy, productive senior, able to plan and organise his own activities by him/herself and on the other hand the person with different health impairments and disabilities is in his/her activities limited (Wittmannová, 2006, 2007). For sure we can say that decreased level of physical fitness significantly negatively influences the seniors' QOL level.

World Health Organisation (WHO, 1998) specifies the QOL as "expression of that, how human perceives his/her own attitude to life in the context of culture where he/she lives related to his/her own targets, expectations, life style and interests". Farský et al. (2007) indentified the factors that affect the QOL in seniors living in community institutions. They include self-assessment (subjective assessment of somatic, mental and spiritual comfort and health of senior); functional potention in society; change of living conditions, acceptance or adaptive-arming factor fixed to institutional living; effective processing of loss.

Initiative of WHO QOL (Dragomirecká, Bartoňová, 2006) determined six QOL domains with following indicators agency:

1. Physical health (energy and fatigue; pain and discomfort; sleep and rest).

2. Psychological health (body image and appearance; positive feelings; negative feelings; self-esteem; learning, thinking, memory and concentration).

3. Level of independence (mobility; activities of daily living; dependence of medicinal substances and medical aids; work capacity).

4. Social relationships (personal relationships; social support; sexual activity).

5. Environment (financial resources; freedom, physical safety and security; health and social care; home environment; opportunities for acquiring new information and skills; physical environment – pollution/noise/traffic/climate; transport).

6. Spirituality (religion/personal beliefs).

Kováč (2003) brings his own hypothetical QOL model consisted of characteristics and levels.

1. Basal-life level,

2. Mezzo-individual-specific level (civilization),

3. Meta-elite (cultural-spirit) level.

This Meta level represents spiritual comfort coming from self-cultivation thorough culture and spiritual values accepted by individual, group or society. That result that QOL

cannot be derived only from basic level of needs satisfactions but also by art activities, sport, interests etc. Kováč closes by expression that "term QOL is multidimensional phenomenon where more or less integrated accesses dominates".

Aim

The article presents the introduction into the research of qualitatively forming features in elderly peoples' lives. We tried to extend and specify knowledge about selected quality of life indicators as a part of different domains.

Tasks

A. Analyze seniors' opinions on four basic qualities of life domains:

1. Physical health and level of independence.
2. Psychological health and spirituality/religion.
3. Social relationships.
4. Environment.

B. Compare the differences in importance of selected quality of life indicators between elderly men and women.

Methods

102 respondents aged 60 – 92 years (35 elderly men and 67 elderly women) mostly with high school educational level (42 % with leaving examination and 33% without leaving examination) living mainly an active life style (59 %) participated in our research. As table 1 presents, mostly elderly women (69 %) are participating in regular exercise or physical activity comparing elderly men (40 %). Relating to organisation form of exercise, they prefer to exercise individually. 85 % of elderly people of our sample are retired, they only draw regular pension. Only 12 % of them still work actively and receive an income simultaneously. Two respondents have full-time jobs and one works part- time.

Table 1

Life style of respondents

Life style	**Organisation form of exercise and physical activity**	**Men**	**Women**
		%	
Active	Group	9	17
	Individual	17	39
	Group and individual together	14	13
Active total		**40**	**69**
Sedentary total		**60**	**31**

Empirical data were obtained by first part of a standardized questionnaire S.QUA.LA (scale assessment of importance). It is the general questionnaire about the quality of life aimed at gaining information acquirement from healthy population as well as from people with different kinds of disability, mostly mental. Questionnaire assesses subjective views of life situations where an individual is assessing his/her satisfaction or dissatisfaction with different areas (QOL indicators) of her own life. Subjective QUAlity of Life Analysis S.QUA.LA (Zannoti, Pringuey, 1992; Dragomerická, et al., 2006) includes 23 QOL indicators relating to external and internal realities of everyday life. In each indicator on five-grade assessing scale, the respondents evaluated subjective importance of each area and so specified how they are satisfied / dissatisfied with the particular QOL indicator. Value 1 – 2 indicated positive assessment, value 3 neutral and values 4 – 5 negative assessment. For statistical evaluation of achieved data, we used average value of responses, and for statistical significance of differences between elderly men and elderly women, we used Chi-square (evaluation of qualitative values) at 1 %, 5 % and 10 % level of statistical significance.

For more clear results interpretation we included different QOL indicators obtained in S.QUA.LA into the different QOL domains relating to WHO categorizations (Dragomirecká, Bartoňová, 2006) as follows:

1. Physical health and level of independence (being healthy, feel physically well, good sleep, relaxation in leisure time, to have free time activities, being physically independent, take care of yourself, sport participation/exercising in leisure time, work).

2. Psychological health and spirituality (to love and to be loved, justice, beauty and art, truth, to be interested in politics, good food, to have faith/religion).

3. Social relationships (relationships in family, relationships with other people, to have and to raise children, to have sexual life).

4. Environment (pleasant living environment, to be secure, freedom, money).

Results and discussion

When assessing the opinions on QOL indicators in domains **physical health** and **level of independence** two indicators showed statistically significant differences and concretely ***work*** at 5 % level of statistical significance and indicator ***feel physically well*** meant 10 % level of statistical significance when both indicators were more important for elderly women than for elderly men in their life. Even the other indicators did not showed any statistically significant differences comparing the importance between elderly men and elderly women, two indicators ***health*** and ***physical independence*** have equal meaning in life of both genders. ***Health*** was simultaneously at the first place in both genders according to importance of evaluation all QOL indicators. The value 1 (the most important) have signed 75,5 % and for value 2 (very important) have signed 22,5 % of seniors. For the last four QOL indicators (***to take care of yourself, good sleep, relaxation in leisure time and to have free tome activities***) belonging into the domains of **physical health** and **level of independence** attach elderly women in their lives a little bit higher importance than elderly men, when average value of their responses was lower than in elderly men. Out of four-mentioned QOL indicators both genders considered relaxation in leisure time as the less important in their life.

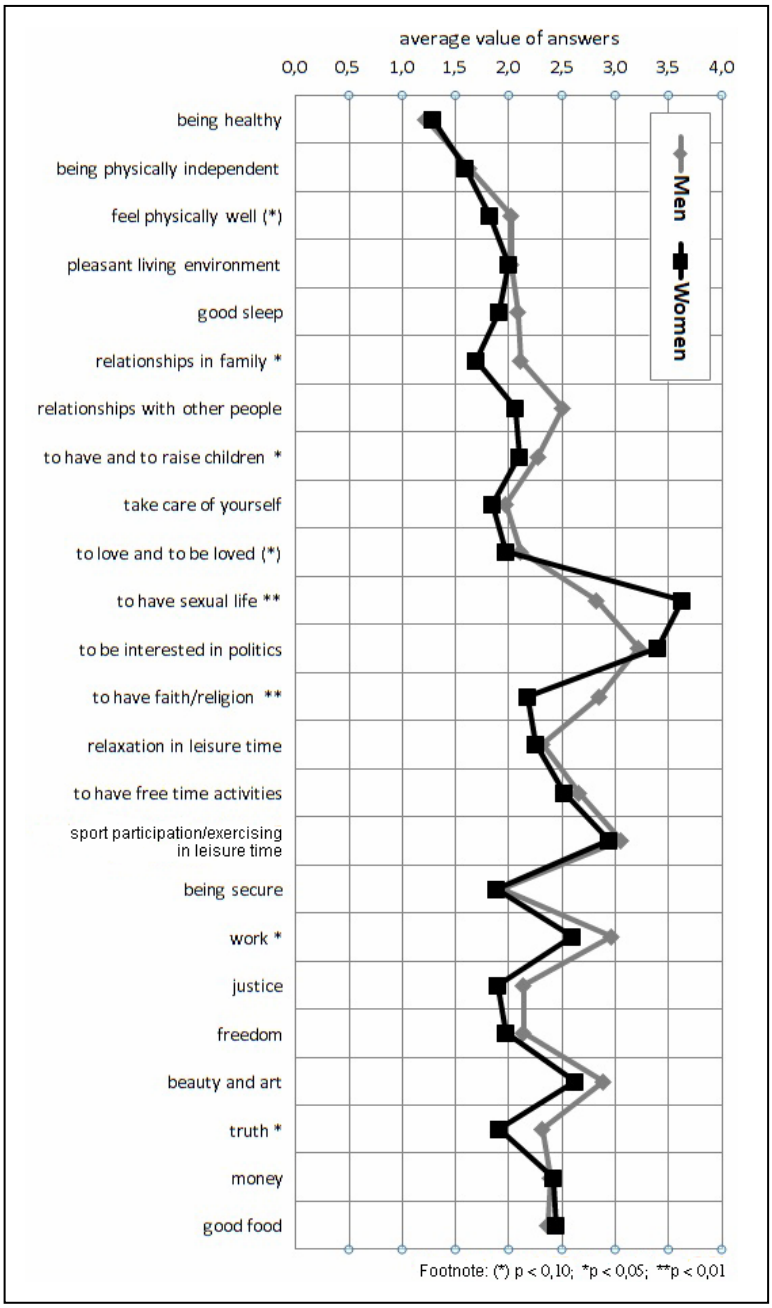

Figure 1

Comparison of opinions to QOL indicators between elderly men and women

We paid special attention to last QOL indicator belonging into domains of **physical health** and **level of independence** – ***sport participation/exercising in leisure time***. We found out, that sport participation and exercise in seniors' life have not big meaning (average value of responses in both genders was 3, that meant only middle importance in their life), even regular participation in physical activity in higher age contribute and help them not only in encouraging their health, but also to be independent from others up to higher age by maintaining or increasing their physical fitness (Nemček, 2010). Statistically significant difference in opinions to particular QOL indicator between genders was not registered because average values of responses in both genders reached up approximately same values (men – 3,057, women – 2,94). When we compare the participation in physical activity with presented opinions on the importance of life we see, that elderly women are much more active (table 1) in their life than elderly men and also by questionnaire they presented higher importance to sport and a need for exercise in personal life than men.

In domains **psychological health** and **spirituality** according to two QOL indicators we registered statistically significant differences. The indicator ***truth*** that was at the 5 % level of statistical significance when in elderly women considered this QOL indicator more important in life than elderly men. Higher statistically significant difference was manifested between genders in ***faith and religion*** ($p < 0,01$) when in women's life having faith and religion mean lot more than in men's life. ***Good food*** the next QOL indicator belonging into these domains is for both genders equally important, because average values between elderly women and elderly men differ only minimally (men – 2,371, women – 2,448). Evaluating the opinions regarding the last QOL indicators we found out, that elderly women comparing elderly men consider ***love*** – taking and giving, ***justice*** and aesthetics included in ***beauty and art*** to be more important in their life**.** On the other hand the higher ***interest in politics*** presented elderly men but his QOL indicator in the overall assessment was considered by both genders as less important in their life. The value 4 and 5 (negative assessment) presented 44,2 % of our respondents and only 22,5 % of elderly people considered politics as an important (value 1, 2) part of their life. For 33,3 seniors mean politics middle important (value 3) QOL indicator.

In assessment of all QOL indicators in eight of them we registered statistically significant differences between elderly men and elderly women, when in domain **social relationships** all four QOL indicators showed statistical significance. Three of them, concretely ***relationships in family*** ($p < 0,05$), ***relationships with other people*** ($p < 0,10$), ***to have and to raise children*** ($p < 0,05$) are more important in women's life than in men's life but on the other side ***sexual life*** ($p < 0,01$) is considered as more important by elderly men comparing elderly women. This QOL indicator in whole assessment appertains among the less important indicators (together with indicator ***to be interest in politics***), when values 4 and 5 (less important and unimportant) presented 44,1 % of our respondents and only 22,5 % considered sexual life as important part of their life (value 1, 2). For 33,2 % elderly people means sex in their life only middle importance. In general we can say, that their own children, very close relatives and friends are much more significant for elderly women than for elderly men.

In domain **environment**, in none of QOL indicators was documented a statistically significant difference because opinions to these QOL indicators in both genders were approximately same. In general we can say that ***pleasant living environment***, ***safety*** and ***money*** are similarly important in life for both genders equally and the last QOL indicator

freedom is little bit more significant in women's life comparing men, when difference in responses between elderly men and women was only 0,173.

Conclusion

On the basis of questionnaire that consisted of questions related to significance of different quality of life indicators we found out that expressly for both genders is ***health*** the most important in their life and on the other side ***sexual life*** and ***politics*** are the most unimportant quality of life indicators for elderly people.

In the answers to these questions between groups of women and men significant differences exist. The highest difference that we registered were in domain of **social relations,** for women are their own ***children***, near ***relatives*** and ***friend*****s** much more significant that for men in seniors age. The indicator ***relationships with other people*** surprised us the most. Is at the level of positive evaluation but we expected its higher need in their life, mostly in elderly men and simultaneously we want to recommend the possibilities of higher socialization of elderly men by creation of motivating activities interesting for men in old peoples' houses.

Physical, **mental health** and **spiritual** domains have in the life of elderly women more significant place than in elderly men's lives. Even indicators ***being physically independent, feeling physically well*** and ***take care of yourself*** show high importance in seniors' life, on the other side ***sport*** and ***exercise*** participation, which significantly support these indicators, is for them just slightly important. Especially free time (***hobbies*** and ***relaxation***) that wasn't so much important in senior's life; they should be more physically active by participating in physical activities as a part of their leisure time activities – an active relaxation or as a prevention or deceleration of negative involution changes of organism influences. Here there is a higher need of appropriate physical activities propagation for elderly people by for example dissemination in clubs for seniors and old people's houses. Those should be a part of weekly program and on the time – table in these institutions.

As well cities and communities should be more active in activities in the field of offering appropriate physical activities for citizens in senior's age by form of sport for all activities (trips, hiking, group exercise, health-related exercise for elderly people) with an accent on bigger motivation of elderly men.

References

1. ADAMÍK, P. et al. 2007. Hodnotenie zdravia rodičov psychicky chorých detí. In BUŽGOVÁ, R. a JAROŠOVÁ, D. (ed.). *Ošetřovatelská diagnostika a praxe založená na dúkazech*. Ostrava: Ostravská univerzita, 2007, s. 7-12.
2. BENDÍKOVÁ, E. 2010. Význam pohybovej aktivity v spôsobe života senioriek. In *Telesná výchova a šport*, 2010, roč. 20, č. 4, s. 10-15.
3. BUNC, V., ŠTILEC, M. 2007. Tělesné složení jako indikátor aktivního životního stylu seniorek. *Česká Kinatropologie,* 11 (3), s.17-23.
4. DINGOVÁ, M., NEMČEKOVÁ, M. 2008. Metodologické problémy výskumu kvality života rómskeho etnika na Slovensku z hľadiska ošetrovateľstva. *Kontakt*. 2008, roč. 10, č. 2, s. 274-282.

5. DRAGOMERICKÁ, E., BARTOŇOVÁ, J. 2006. *Příručka pro uživatele české verze dotazníků kvality života Světové zdravotnické organizace* WHOQOL-BREF a WHOQOL-100. Praha : Psychiatrické centrum, 2006. 92 s.
6. DRAGOMERICKÁ, E., et al. 2006. *SQUALA.* Príručka pre používateľov českej verzie Dotazníka subjektívnej kvality života SQUALA. Praha : Psychiatrické centrum Praha, 2006.
7. FARSKÝ, I. et al. 2007. *Problematika kvality života v séniu*. 1. vyd. Martin : Profa, 2007. 70 s.
8. GURKOVÁ, E., ŽIAKOVÁ, K. 2009. Konceptualizácia kvality života v ošetrovateľstve. *Profese on-line* [online]. Apríl 2009, roč. 2, č. 2. [cit. 2009-05-29]. Dostupný z www: http://www.pouzp.cz/text/cs/konceptualizacia-kvality-zivota-vosetrovatel-stve.aspx
9. KOVÁČ, D. 2003. Quality of life: A paradigmatic challenge to psychologists. *Studia psychologica*, 45, 2003, 2, s. 81-101.
10. NEMČEK, D. 2009. Level of motor abilities determine risk of falls in elderly women. Physical education and Sport in Research 2009. *Aging and Physical activity*. Book of abstracts. Leszno : Panstwowa wyzsza szkola zawodowa, s. 97.
11. NEMČEK, D. 2010. *Úroveň vybraných pohybových schopností žien v staršom veku*. Bratislava : SZ RTVŠ, 2010. 115 s.
12. NEMČEKOVÁ, M. et al. 2000. Práva pacientov. *Filozofická reflexia a zdravotnícka prax*. 1. vyd. Bratislava : Iris, 2000. 234 s.
13. PAYNE, J. et al. 2005. *Kvalita života a zdraví*. 1. vyd. Praha : Triton, 2005. 629 s.
14. TOBIŠKOVÁ, L., JAROŠOVÁ, D. 2009. Hodnocení kvality života seniorů v domově-penzioně pro důchodce. In ČÁP, J. a ŽIAKOVÁ, K. (eds.). *Teória, výskum a vzdelávanie v ošetrovateľstve a pôrodnej asistencii* [CD-ROM]. Martin : JLF UK, 2009. s. 564-570.
15. WHO. 1998. Programme on mental health. *WHOQOL User Manual.* Geneva: Department of Mental Health, World Health Organization. 106 s.
16. WITTMANNOVÁ, J. 2006. Ageing and disability – European thematic network in APA (THENAPA II.): Activities on the Czech national level. In J. Wittmannová (Ed.), *EUCAPA 2006 – 8th European conference of adapted physical aktivity.* Olomouc : Univerzita Palackého.
17. WITTMANNOVÁ, J. 2007. Projekt EU THENAPA II Stárnutí a postižení: Nový průsečík mezi pohybovou aktivitou, sociálním začleněním a celoživotním pocitem spokojenosti. In J. Wittmannová (Ed.), *Aktivní v každém věku: pracovní seminář odborníků v oblasti pohybových aktivit seniorů* (s. 11-15). Olomouc : Univerzita Palackého.
18. ZANNOTTI, M., PRINGUEY, D. 1992. A method for quality of life assessment in psychiatry: the S-QUA-L-A (Subjective QUAlity of Life Analysis). *Quality of life News Letter*, 4, 6, 1992. 21 s.

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RESUMÉ

ROZDIELY V NÁZOROCH NA VYBRANÉ INDIKÁTORY KVALITY ŽIVOTA MEDZI MUŽMI A ŽENAMI V STARŠOM VEKU

Dagmar Nemček

Kvalita života by mala vyjadrovať komplexný subjektívny a dynamicky sa meniaci stav jednotlivca. Hodnotenie kvality života, jej jednotlivých indikátorov, sme v našom výskumnom sledovaní realizovali dotazníkom SQUALA na vzorke 102 respondentov (35 mužov a 67 žien) vo veku nad 60 rokov. Výsledky sme diferencovali z hľadiska pohlavia. Obe pohlavia súčasne hodnotia zdravie ako najdôležitejšie v ich živote a na druhej strane sexuálny život a politika sú najmenej dôležité indikátory kvality života starších ľudí. Štatisticky významné rozdiely sme zaznamenali v doméne sociálnych vzťahov. V živote ženy sú vlastné deti, blízka rodina a priatelia oveľa významnejšie ako v živote muža. Podobne aj doména fyzického zdravia má v živote starších žien významnejšie miesto a tak isto duchovno je v živote ženy významnejšie ako v živote muža v staršom veku. Športovanie a cvičenie v živote seniorov nemá veľký význam.

EXPERIENTIAL GATEWAY INTO SPIRITUAL DIMENSION IN SPORT

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Summary: The contribution thematizes the connection of spirituality and sport and shows the usefulness of uncovering this relatively new dimension of sport by way of an example of experiential orientation. Out of the sphere of exceptional experiences (EHE – Exceptional Human Experience it notices those with relevance to sport and takes up in detail the so called peak experiences and flow experiences alias zone experiences. In conclusion it indicates possible leads ways for to optimal choice of experiences with the potential of positively influencing our life.

Keywords: flow/zone experience, peak experience, experience, spirituality, sports humanities

Introduction

Spirituality and sport – new connection, that has been the most discussed topic in the last decade and it has been discussed in the field of kinanthropological theory, practiced in sports practice. If we leave out the area of so-called Eastern thinking, then this topic appears mainly in the United States of America. Initially, it appeared in the form of connection of sport and *religion.* – This fact is well known from the sports history where some types of sports like basketball and volleyball were invented by religious organizations. YMCA is the best known in this aspect that soon (already by the end of the 19th century) realized this potential (especially acquisition of modern sport was realized). During the 20th century the role of sport undoubtedly grew and sociologists started to notice that sport was here to play the role of "substitute" religion – it had its own faith, rituals and devoted sympathizers… Let us mention the book "From Season to Season" by Joseph Price (2001 with subtitle "Sports as American Religion". Even in 2007 Craig Forney published book with "heretical" title: "The Holy Trinity of American Sports: Civil Religion in Football, Baseball, and Basketball". Even sports psychology expressed greater interest in spirituality in sport (Watson, Nesti, 2005.

In 2007 worldwide initiative "Sport and Spirituality" as a follow-up the conference of the same name at St. John's University in York was established (at the same time, organizational center for study of this issue was established here, today it is transferred to University of Gloucestershire, which several sport philosophers from the Czech Republic and Poland attended. Conference contributions became the basis of monograph that was published this year under the title "Theology, Ethics and Transcendence in Sports" (Parry, Nesty and Watson, 2011).

Spirituality turns to be more suitable umbrella term for this field – it removes some negative connotations connected with the term "religion" and extends the scale of issues. Which of them are thematized in the intersection of spirituality and sport?

* There is mainly the issue of *transcendence*, which forms the core of spirituality. It is not only the issue of absolute overlap (religion can be found on this vertical, but also on horizontal transcendence that is closer to specific life and to the sport as well). We have in mind stepping out of the ordinary norm toward what is "beyond the ordinary". It can be an overlap of regionally bound cultural scheme (transculture) – for example opening or closing ceremonies of the Olympic Games, or typical, narrowly defined personality (transpersonality) – all team sports are good teachers here or of what is immediately given (transaparence) – the overlap of what is obvious, thus apparent; purposeful and long-term sport activity leads to it, etc. There is an interesting question whether the athletes are "transcenders", thus transcendence-able personalities.

* Questions of conscience, values and meta-values, spiritual development of character, meaning of life – here, on one hand we search for possibilities of sport or wider physical activities to contribute to the enrichment of reflection of this thematization. On the other hand we look for the positive impact of presentation of this topic on sporting scene.

* Spiritual dimension of olympism as a life philosophy; especially some of the Coubertin´s thoughts that were ahead of their time (for example "religio athletae") are inspiring.

* Usage of spirituality in sport counseling and so called mental coaching where we search for the ways to increase the performance and we hope for personal development of the athlete as well.

* Sphere of *experiences*, especially those exceptional ones, known as the EHE ("Exceptional Human Experience"). In this very special area we want to analyse, in details interdisciplinary approach, from the point of psychology, philosophy and kinanthropology or the sports humanities.

Experiences

Experiential orientation became evidently one of the characteristic attributes of contemporary era. There are personal experiences as well as group ones. Increasing demand even turned the experiences into specific market commodity. The risk of exposing the experiences to inflationary process or to the spiral of mere escalation of intensity in case of dissatisfaction, that regularly appears, is not small. In contrast to what we know is that quality experience can open the gateway toward transcendence or direct our life toward meaningfulness or finding life theme and it has the strength to change our life.

The question is where is the adequate level of our effort to experience something beyond everyday life? Is it possible to find criterion for quality of experience alias for the right selection? What types of experiences should we strive for? Is the desire for experiences similar as the pursuit of happiness?

"The more persons aims at delight, the more he is going to miss it. The more he aims at happiness, the more he also drives it away. /…/ *happiness can be ensued but it cannot be pursued.*" (Frankl, 2006)

There are other questions that appear when we think about the overlap of sport and experiential sphere: Does the accomplishment of optimal experience increase the sporting performance? Does it help to increase the quality of life of the athletes? Does the experiential pedagogy have the chance to "flip the switch" of the one-sided performance orientation toward the experiential?

Before we try to outline the answers, we feel the need to explain the *term* of experience in psychology and philosophy as they have a lot to say about it.

In *psychology*, experience is the subjective experience of certain reality; mental occurrence that the individual experiences or experienced psychological contents. It is quite common matter – experiences pile up and form the mental richness of every person. Petr Hudlička analyses thoroughly the psychological view of these issues (Hudlička, 2003) overview of the basic psychological definitions of experiences in the field of kinanthropology is given mainly by Ivo Jirásek (Jirásek, 2001 and Jiří Kirchner 2009). Václav Hošek and Běla Hátlová state inspiring definition: "Experience is strong emotional memorial episode that has the tendency to be recalled associationaly often." (Slepička, Hošek and Hátlová, 2009). We like the certain selection of those psychological phenomena toward exclusivity, we slightly don't like the term "memorial", which removes indirectly one important attribute of experiences, and that is its immediacy in the mode of the present. We would adjust the definition in this way: "Experience is strong emotional episode that has the tendency to be recalled associally often and in the form of memories revive its original immediacy."

In *philosophy* the experience is specific penetration of an individual and the world the world (cp. especially Jirásek, 2001, 45) this is the way how perceptual field is formed (Maurice Merleau-Ponty) and we can analyse its components – ego, body, "things of the world", etc. On the top of that philosophy views we consider the experience as the way toward the *entirety* and toward *meaning*. Direction toward the entirety requires exceeding the subjective ego sphere, thus transcending. If this surpass has specific aim, we talk about intentionality.

Hans-Georg Gadamer points out: "Representation of the whole in the immediate experience obviously exceeds the fact of determination of the experience by its subject." (Gadamer, 2010) Gadamer speculates about the wholeness of *life* of the one experiencing – since the experience is connected with the whole life motion, let us add that it's not loose connection, rather symbiotic. This is also his advantage over "dry" knowledge where we work mainly with picture and image – here we have emotional bonus and the effect of *physical anchor*. Thus the sharpened interest of kinanthropology. We see then that the experience affects more dimensions of one's personality – aside from cognitive, also emotional, physical and conative because it requires involvement of "active part".

There is very important moment of experience analysis and that is its *temporality*. Experiences live in its own time and have some kind of *double life*: the original, unrepeatable – and the one completed by reflection, analysis or memories that make it alive, arising from the flow of life. This revival of feelings, emotions and perceptions do not need to be only autotelic return to the past, but it can have the strength of inspiration or warning.

Repeated revitalizations place the original experience into new connections, into different contexts and thus create also the *meaning* – of the experience itself and its participation on the meaning of life. The perspective of our reflections changes – exactly

because our life is in motion. The *meaning* of the experience is essentially unlimited – if it remains exposed to new evaluations and not encapsulated or hidden.

Exceptional experiences

In the previous text we could notice the interest of psychology in more common sets of experiences, whereby philosophy notices rather the more important and sense-making ones. Only internal interests do not carry reflections of these fields but they are natural reflection of social reality as well. And that shows – as indicated already in the introduction – the constantly growing interest in this phenomenon during the last decades. Sometimes, the literal pursuit of experiences, mainly those exceptional and "new", forced psychology and philosophy to track this expansion and extend their preserve into formerly unprecedented spheres. Psychology even found the tendency toward seeking new, exceptional impulses, perceptions, excitement or experiences. Sensation Seeking Tendency is to be significant personality trait and talks about "new experiential sport subculture" in the sphere of sport and physical activity. (Kirchner, 2009)

Perhaps there is nothing more characteristic for the post-modern time than creating an interest group on the Internet – in our case; it was created already in 1990 with the title "Exceptional Human Experience Network" (EHEN. It focuses on both collecting records of exceptional experiences and on its interpretation and searching for connections. In the case of the founder of this "movement", Rhey White (1931 – 2007 we can speak of theoretical approach.

Today, this group presents among others menu of 523 (!) "exceptional" experiences. Even though there is duplicity in many cases, where the same event is described under different name, still there are more than 400 experiences recorded. In the sport sphere we can find e.g. synergy experiences (team sports, defeat, "reaching the bottom", "looking into the face of death") mountain climbing, motor sport or other highly risk sports, experiences of success, staying in the so-called "zone" (see below, experience of vertigo) vertigo means vortex in Latin, etc. The most known are *flow* and *peak experience*, that often become "mantra" for the coaches and the goal for the athletes. Sport experiences started to be interesting even for the theory and join the "leaders" of this sphere, such as experiences of art or aesthetics (Gadamer considered these as fundamental and religious experiences). Abraham Maslow started his research with these.

Let's look in detail at two types of experiences that are the most frequent in sport theory and practice.

1. Peak experience *(further PE is the term by Abraham Maslow)*

"Peak experiences" brought fame to Maslow no less than his "hierarchy /pyramid/ of needs". This concept came up to him already in the 50th on the edge of the issue of "self-actualisation" (Maslow, 1954; in 1959) he wrote the article called "Cognition of Being in the Peak- Experiences" and in 1964 he published "Religions, Values, and Peak-Experiences", where these experiences are in the centre of attention.

The problem of the exact interpretation on Maslow's conception is hard to solve: the author has been presenting long lists of characteristic traits of PE over the years without any classification and also he changed partially his attitude and opinions. Thus for example in

his next book that has two chapters devoted to PE, "Toward a Psychology of Being" (Maslow, 1962), he names 19 traits in the cognition of being (chapter 6) and another 16 traits regarding identity (chapter 7); in the appendix of "Religions, Values, and Peak-Experiences" he then lists another 25 traits (Maslow, 1964, appendix A) in the connection to religion.

Instead of trying to define PE we choose those traits from this mosaic that we consider to be substantial:

1. high concentration of attention;
2. disappearance of self-centeredness (ego-transcending);
3. independence of interests and purposes;
4. experience felt as incommunicable and not able to be evaluated from the outside;
5. absence of fear, anxiety, doubts or inhibitions;
6. everything is perceived as having the same importance (especially another person);
7. everything is perceived positively – transcendence of polarity (I understand even the bad aspects of the world);
8. everything is perceived as sacred (even death);
9. disorientation in time and space – I perceive "sub speciae aeternitatis";
10. the world is perceived as integrated unit;
11. bringing the meaning to (personal life).

While at first Maslow compares PE to mystical experiences, in his declining years he secularise them: "The term, peak experience is the generalization of the best moments of human being, the happiest moments of life, experiences of ecstasy, enthusiasm, blessedness or the greatest joy." (Maslow, 1971. At the same time he crosses "inconspicuously" over to the position "plateau experience" (see below.

Sport as possible PE source did not appear to Maslow yet even though he was close with reference to dance. However, sport psychology took interest in PE very soon, especially its section that did not mind the overlap toward spirituality or esotericism. Probably the first one was American sport psychologist Ken Ravizza who published article "Peak Experiences in Sport" already in 1977 and has been carrying on the research and practical application (he serves also as "Peak Experience Consultant" PE until today. In the quoted article he examined "the most important sport experiences" of 20 athletes and during the analysis he noticed striking concordance with many PE traits. There was also something else: close connection of given activity and alertness *did not require* voluntary effort; reaching PE was conditioned by higher level of "mastery" of managing the relevant activity. This necessary initial requirement ("task mastery") was subsequently confirmed during other researches of PE and "flow" state and that not only in sport. However, it becomes the only "small certainty" in substantial uncertainty if we want to cause or bring PE about and who would not want to reach – preferably repeatedly – these largely positive states. Maslow states it unequivocally: "Peaks are not planned nor prepared, peaks happen." (Maslow, 2000). Of course, this is an unpleasant problem for sport "planners" who want to realize record projects and PE should be the "miraculous pill of success"…

2. Flow experience

(further FE) is closely connected with the name Mihály Csikszentmihályi

According to his own words (Csikszentmihalyi, 1990) he addressed this special positive state of "flow" of psychological energy that is accompanied by emotional tinge of joy even happiness in his dissertation (1965 – not published) when he researched the creativity of artists and after several publications in magazines, he "fully" introduced it in the book "Beyond Boredom and Anxiety" with subtitle "Experiencing *Flow* in Work and Play" (1975) emphasized by M. B. After another fifteen years of work when the author involved many other researchers in the empirical research, this phenomenon became generally known after the publishing of the book "Flow: The Psychology of Optimal Experience" (1990, which connected specialized and popularisation aspect.

Here we choose significant traits of FE:

1. deep "absorption" into the activity (gradually, it became apparent that it may be wide scale of activities that provides feedback continuously);

2. optimal and effective arrangement of psychological energy (Csikszentmihályi talks about *negentropy*, transferring the thermodynamic term, known as the state of order apart from entropy chaos, into the micro world of humans);

3. balance between challenge (contained in the given activity and ability) needed to fulfil the "task";

4. autotelism (goal within oneself);

5. distorted sense of time;

6. loss of the feeling of self-consciousness – nevertheless, feeling of personal significance dominates after FE fades away (we dare to interpret it in this way: toward self-elevation through self-oblivion);

7. sometimes there is a feeling of connection with something that goes beyond, what is "greater than us";

8. sense of personal control over the given activity;

9. action and awareness (or the thoughts contained in it merge into one);

10. absence of thoughts of failure.

Csikszentmihályi noticed very soon that often athletes talk about the flow type experience – but they used different choice of words, using "zone experience" (further ZE) when describing feelings in the moments of their top performance. "Being in the zone" became the wish of many athletes and the task for sport psychologists or special "mental coaches" to induce this state. They started to study the zone phenomenon theoretically – the book "The Inner Game of Tennis" by Timothy Gallwey (1974 is probably the oldest specialized work of this type. The most influential work on this field is "In the Zone: Transcendent Experience in Sports" by Michael Murphy and Rhey White (1995). Dillon and Tait (2000) speculate about the connection between ZE and spirituality.

11. Apart from the mentioned FE traits, the sport ZE research noted some other traits of these experiences:

• feeling of exceptional lightness with which even the top performance is given;

- unusual combination of inner peace and readiness to dynamic action – it all leads to maximal (maybe rather: optimal performance in most cases);
- lack of awareness of bodily needs (happens particularly during long term persistent strain);
- higher occurrence of alfa waves;
- absence of pain and stress;
- staying in one's own world (or "personal heaven" – "big world" disappears or comes to a standstill).

If we compare PE and FE/ZE, we notice stronger bodily anchorage of the second group – practically only point 7 has immediate spiritual intention; when explained on the basis of three-component human being: the focal point of FE/ZE is rather in the psycho-somatic sphere and psycho-spiritual in the PE. When projected into the sphere of body culture: it seems that ZE/FE is the better tool for application, and that especially because of greater chance to reach these conditions deliberately and "keeping" them longer in time. Unlike the PE they have the processual character and wider time "unfold". We think that the PE renaissance in sport when the considerable interest in this "miraculous" phenomenon in the 80th and 90th passed already can bring greater interest in connecting sport and spirituality. There is not only increase of performance in stake, but also the development of the "art of living" life-skills development that should not be the ability "offside" even in the sphere of sport.

In his declining years even Maslow realized the higher exclusiveness and randomness of PE "arrival" and started to promote the "plateau experiences". Promote – but he did not research them. His new foreword for the book "Religions, Values and Peak-Experiences" from 1970 is the most interesting in this connection. He says about the "plateau experiences": "These are serene and calm reactions to miraculous, terrifying or sacred things /…/. In comparison to peak experiences, these are less emotional and always include noetic and cognitive elements. They are also much more under voluntary control. /…/ We could describe them as balanced cognitive blissfulness. /…/ Plateau experiences are often experienced as pure joy and happiness." (Maslow, 1994). Does it remind us something? Yes, Maslow reached the point here, from which Csikszentmihályi started later with his "flow" and took over the imaginary relay. Though he lowered somehow the Maslow's higher plateau paradigm into the everyday life and made it accessible even for the "ordinary people". Thus even for the "ordinary athletes".

Conclusion

We "prompt" some "correct" solutions of optimal choice of such experiences that have the potential positively influence our life:

* Apart from the promoted orientation of life to "3 A's", which is to be authentic, autonomous and autarchic, we plead on behalf of the fourth "A" in the Csikszentmihalyi's intention (but also already Aristotle! – to be *autotelic*. The key for understanding is the Greek "telos", goal or purpose; the component "auto-" represents the source originated from the inside – creative activities of multiple types. "It refers to self-contained activity, one that is done not with the expectation of some future benefit, but simply because the doing is the reward." (Csikszentmihalyi, 1990 Among others, such orientation is the core of

the famous definition of *play* by Johan Huizinga: "Play is voluntary activity that is executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, *having its aim in itself* and accompanied by feeling of tension, joy and the consciousness that it is, different' from, ordinary life'." (Huizinga, 2000, 44 – emphasized by M. B).

Maybe unexpectedly the autotelic "imperative" is hidden in one of the less known formulation of Kant's categorical imperative: "Act in such a way that you treat *humanity* whether *in your own person* or in the person of any other, always at the same time *as an end* and never merely as a means to an end". (Kant, 1910, 54 – emphasized by M. B. Yes, also the "own humanity" cannot serve as the means to reach somebody else's aims. Negative example of doping comes to mind, as it serves as the means to reach the goal, hostile toward "humanity" of the athlete's body and soul…

The opposite of autotelic orientation is the exotelic direction where the aim is "given from the outside". Unfortunately, often it can be seen even in the sport sphere, where young athlete fulfills the will of parents or coaches; or when the national team member is pushed toward implementation of ideological goals of the state, etc. However, let us note that it is not possible to be always exclusively autotelic in practical life – amalgam with exotelism is realistic, when ideally I should identify internally with the external aims and adopt them as mine.

In the ancient world, the term purpose was often connected with the term *good* (agathon – we know it among others from the "hideout" in the second part of the word "kalokagathiá"), because the aim included the good for each entity which preserved it. Let us add – beyond the ancient world – that well selected aim/purpose has the potential not only to keep but also to develop.

* it is necessary to strive for such experiences that move us on Maslow's hierarchy of needs from the deficit ones ("D-needs") toward the *growth* ones ("B-needs"). The final aim of these is in meta-values, such as for example truth, beauty, perfection, order, self-sufficiency and other (cp. Maslow 1994, 92 – 94).

The horizon of meaning emerges here as well: "Experience … is process aimed to certain direction … process aimed to self-realization, creating sense." (Hudlička, 2003). We separate from the continuity of common life – at the same time it is necessary not to loose *relationship to entirety* of this life.

* It is good to *consolidate in Being* (Krishna's wisdom – advice to archer Arjun - from Mahabharata before the "experiential event" and only then perform. Yoga understands it as unity and "constant living coexistence of inner peace and outside activity". (Douillard, 2003). At first, let us reach composure and serenity of mind and body, then we can create hurricane… Closer correlation between Eastern thinking and our topic, e. g. in the form of analysis of the term *satori*, and others would be the content of different study.

References

1. BEDNÁŘ, M. 2009. *Pohyb člověka na biodromu:* Cesta životem z pohledu nejen kinantropologie. Praha : Karolinum, 2009.
2. CSIKSZENTMIHALYI, M. 1975. *Beyond Boredom and Anxiety:* Experiencing Flow in Work and Play, San Francisco : Jossey-Bass, 1975.

3. CSIKSZENTMIHALYI, M. 1990. *Flow: The Psychology of Optimal Experience*. New York : Harper Perennial, 1990.
4. CSIKSZENTMIHALYI, M. 1996. *O štěstí a smyslu života:* Můžeme ovládat své prožitky a ovlivňovat jejich kvalitu? Praha : Lidové noviny, 1996.
5. CSIKSZENTMIHALYI, M. 1997. *Finding Flow: The Psychology of Engagement with Everyday Life*. New York : Basic Books.
6. DILLON, K., TAIT, J. 2000. Spirituality and Being in the Zone in Team Sports: A Relationship? *Journal of Sport Behavior*, 2000, 23 2, 91-100.
7. DOUILLARD, J. 2003. *Tělo, mysl a sport*. Praha : Pragma, 2003.
8. FORNEY, C. 2007. *The Holy Trinity of American Sports :* Civil Religion in Football, Baseball, and Basketball. Macon : Mercer University Press, 2007.
9. FRANKL, V. E. 2006. *Vůle ke smyslu :* vybrané přednášky o logoterapii. Brno : Cesta, 2006.
10. GADAMER, H.-G. 2010. *Pravda a metoda I:* Nárys filosofické hermeneutiky. Praha : Triáda, 2010.
11. GALLWEY, W. T. 1974. *The Inner Game of Tennis*. London : Pan Books,1974.
12. HUDLIČKA, P. 2003. *Prožívání – Zkušenost – Životní svět aneb O cestách do světa na zkušenou*. Praha : Triton, 2003.
13. HUIZINGA, J. 2000. *Homo ludens: O původu kultury ve hře*. Praha : Dauphin, 2000.
14. JIRÁSEK, I. 2001. *Prožitek a možné světy*. Olomouc : Univerzita Palackého, 2001.
15. KANT, I. 1910. *Základy k metafysice mravů*. Praha : Jan Laichter, 1910.
16. KIRCHNER, J. 2009. *Psychologie prožitku a dobrodružství pro pedagogiku a psychoterapii*. Brno : Computer Press, 2009.
17. MASLOW, A. 1954. *Motivation and Personality*. New York : Harper & Bros, 1954.
18. MASLOW, A. 1959. Cognition of Being in the Peak-Experiences. *Journal of Genetic Psychology*, 1959, 94, 43-66.
19. MASLOW, A. 1962. *Toward a Psychology of Being*. New York : Van Nostrand, 1962.
20. MASLOW, A. 1971. *The Farther Reaches of Human Nature*. New York : Viking Press, 1971.
21. MASLOW, A. 1994. *Religions, Values, and Peak-Experiences*. New York : Arkana/Penguin, 1994.
22. MASLOW, A. 2000. *Ku psychológii bytia*. Modra : PERSONA, 2000.
23. MURPHY, M., WHITE, R. A. 1995. *In the Zone: Transcendent Experience in Sports*. London : Penguin, 1995.
24. OBORNÝ, J. 2001. *Filozofické a etické pohĺady do športovej humanistiky*. Bratislava : Slovenská vedecká spoločnosť pre telesnú výchovu a šport, 2001.
25. PARRY, J., NESTI, M. and WATSON, N. eds 2011. *Theology, Ethics and Transcendence in Sports.* New York : Routledge, 2011.
26. PRICE, J. 2001. *From Season to Season : Sports as American Religion*. Macon : Mercer University Press, 2001.
27. RAVIZZA, K. 1977. Peak Experiences in Sport. *Journal of Humanistic Psychology*, 1977, 17, 35-40.
28. SLEPIČKA, P., HOŠEK, V., HÁTLOVÁ B. 2009. *Psychologie sportu*. Praha : Karolinum, 2009.
29. WATSON, N., NESTI, M. 2005. The Role of Spirituality in Sport Psychology Consulting: An Analysis and Integrative Review of Literature. *Journal of Applied Sport Psychology*, 2005, 17, 228-239.

RESUMÉ

PROŽITKOVÁ BRÁNA DO SPIRITUÁLNÍ DIMENZE VE SPORTU

Miloš Bednář

Příspěvek tematizuje propojení spirituality a sportu a na příkladu prožitkové orientace ukazuje užitečnost odkrytí této relativně nové dimenze sportu. Ze sféry mimořádných prožitků EHE – Exceptional Human Experience si všímá těch s relevancí pro sport a podrobněji se věnuje tzv. vrcholovým prožitkům peak experiences a prožitkům „plynutí" flow experiences alias „zóny" zone experience. Závěrem naznačuje možná vodítka pro optimální výběr prožitků s potencí ovlivnit pozitivně náš život.

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