

80-495



HUNGARIAN REVIEW OF

Sport Science

Special Issue 2002

Biomechanics

Morphological Properties of Muscles

Nutrition

Dietary Habits of Medical Students

Physical Education

Critical Thinking

ICSSPE

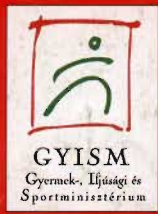
New Board Member
Dr. Zsolt RADÁK



Dr. László NÁDORI

80

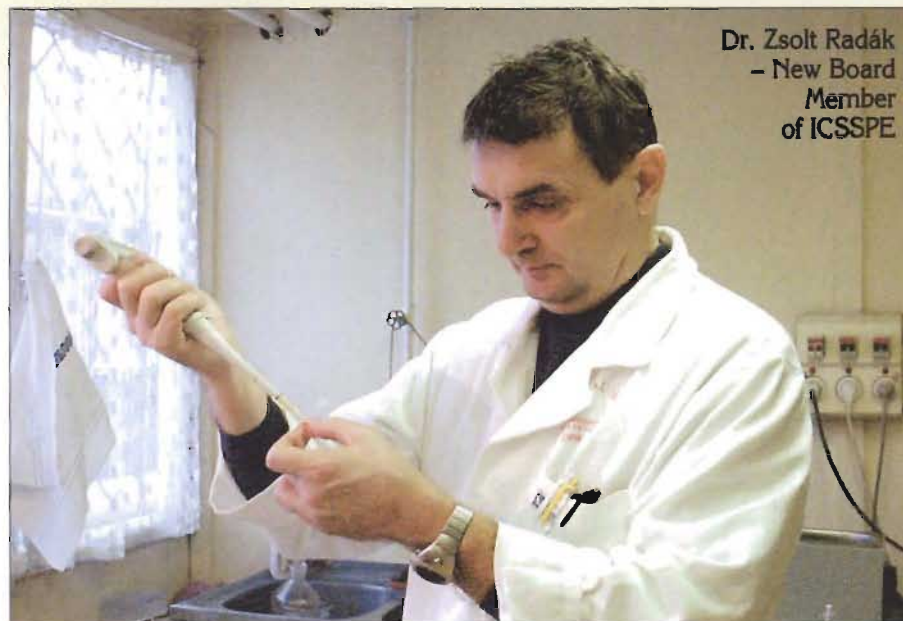
Subventioned by the Ministry of Children, Youth and Sports



Hungarian Society of Sport Science

Contents

| | |
|--|----|
| Professor László Nádori – 80 <i>R. Gallov</i> | 3 |
| Morphological Properties and Specific Tension of the Quadriceps Femoris Muscle <i>J. Tihanyi, P. Bogner, T. Tihanyi, Gy. Gergely, M. Váczi</i> | 4 |
| Dietary Habits of Second-Year Medical Students <i>L. Ángyán, K. Cs. Tolnai, T. Teczely</i> | 11 |
| Physical Condition of Medical Students <i>T. Teczely, A. Pálfai, Z. Gyurkó, L. Ángyán</i> | 15 |
| Critical Thinking: Is it an Issue to Think about in Physical Education? <i>J. Bognár</i> | 19 |
| Physique, Body Composition and Motor Performances in College Students <i>Zs. Szakály</i> | 24 |
| Time Allocation of Teaching and Learning Behaviours in Physical Education Classes: A Comparative Study between Greece and Hungary <i>M. I. Salvava</i> | 30 |
| Examinations of Motor Skill in Kindergarten Children <i>S. Gaál, I. Famosi</i> | 35 |
| A Possible Motor Learning Concept in Sports <i>Z. Vass, M. Varga</i> | 39 |
| Creating Safe Environments through Volleyball <i>D. A. Kluka</i> | 44 |
| Health-Enhancing Physical Activity; from Research Evidence to Promotion <i>P. Oja</i> | 49 |
| Those Magic Free Radicals, Conversation with dr. Zsolt Radák <i>R. Gallov</i> | 53 |
| Round Table of Ministers of Physical Education and Sport Position of the International Council of Sport Science and Physical Education (Paris, January 9-10, 2003) | 55 |
| Directory of Board Members of the International Council of Sport Science and Physical Education (ICSSPE/CIEPSS) | 57 |



Dr. Zsolt Radák
– New Board
Member
of ICSSPE

Magyar Sporttudományi Szemle
Hungarian Review of Sport Science

Megjelenik
negyedévenként
Felelős szerkesztő
Editor-in-Chief
Dr. Mónus András
Szerkesztő
Editor

Bendiner Nóra
Angol nyelvi lektor
English Language Consultant

Rezső Gallov
Vendégszerkesztő
Invited Editor

Dr. Tihanyi József
Szerkesztő kollégium
Editorial Board

Dr. Apor Péter, elnök
Dr. Ángyán Lajos
Dr. Farkas Judit
Földesiné dr. Szabó Gyöngyi

Dr. Győri Pál
Dr. Hédi Csaba

Dr. Mészáros János
Dr. Ozsváth Károly
Dr. Pucskó József

Dr. Radák Zsolt
Dr. Sipos Kornél
Dr. Szabó S. András

Dr. Tihanyi József
Dr. Vass Miklós
Kiadja a

Magyar Sporttudományi Társaság
Published by the
Hungarian Society of Sport Science

Elnök
President

Dr. Frenkl Róbert
Tiszteletbeli elnök
Honorary President

Dr. Nádori László
Szerkesztőség
Editorial Office

1143 Budapest, Dózsa Gy. út 1-3.

Tel./Fax: (36-1) 471-4325

E-mail: mstt@helka.iif.hu

Internet: www.mstt.iif.hu

Hirdetésfelvétel

a szerkesztőség címén

Advertising

in the Editorial Office

Borító, lapterv és tipográfia

Somogyi György

Nyomdai munkálatok

PENTI Nyomda, Budapest

ISSN 1586-5428

Támogatja a
GYERMEK-, IFJÚSÁGI
ÉS SPORTMINISZTERIUM
Subventioned by the
MINISTRY OF CHILDREN,
YOUTH AND SPORTS





Professor László Nádori

80

We can say without any exaggeration really that on January 11 the Hungarian sport scientists, as a matter of fact, the entire community of Hungarian sport, celebrated one of their most popular and best known personalities, Professor Emeritus Dr. László Nádori who is the Honorary President for life in our organisation, in the Hungarian Society of Sport Science. He turned eighty on this day (he was born in 1923, Kisláng, Fejér County) and we ought to make a stop for a moment to pay tribute for his extraordinary achievements in so many different fields.

He is a physical education teacher by his education, academic, university professor, psychologist, biologist, former athlete, skilful soccer player then coach, researcher, special expert on the subject of training methodology, a leading sport administrator, author (or co-writer) of more than forty books and countless studies, member and leading personality of many highly recognised domestic and international sports organisations, further more a politician, two term member of parliament after the historic change in the country's economy, policies and society, between 1990 and 1998. Excellent public speaker, a devoted life-long fanatic of physical activity and every day exercise, mostly swimming, who likes entertainment and music as well, has an excellent sense of humour too and communicates at ease in foreign languages. After all - and the list of course far from being complete - he represents nowadays a rare, almost non-existent and distinct kind of selected people, since he is one of the last true, and modest polyhistorians of our time.

He has a large collection of diplomas, awards and medals for his outstanding activities what we are not able to line up here in order because of the obviously limited pace we have to deal with. Instead we promise, that in our next issue we definitely will publish a lengthier interview with him, and now, as a closing remark, on behalf of our editorial office and a lot of friends of him, we would like to wish the ever young professor perfect health, happiness, further successes and many-many more birthdays. **Rezső Gallov**



Photo: Péter Harsányi

Morphological Properties and Specific Tension of the Quadriceps Femoris Muscle

Tihanyi József, Bogner Péter*, Tihanyi Tekla, Gyulai Gergely, Váczi Márta

Semmelweis University, Faculty of Physical Education and Sport Science, Department of Biomechanics, Budapest, *Kaposvár University, Institute of Radiology and Oncotherapy, Kaposvár

Abstract

Several studies have documented that the muscle force was directly proportional to the cross-sectional area of the muscle. Because the determination of the cross-sectional area (CSA) and the force generated by a muscle was differently carried out in the studies, the stress or specific tension (force divided by the CSA) varied between 20 and 100 N/cm². Therefore the aim of the present study was to calculate the stress for quadriceps femoris muscle determining the anatomical CSA by using magnetic resonance images (MRI).

Eight healthy, physically active male subjects volunteered for the study. MR imaging was carried out on the quadriceps femoris (QF) of the dominant leg with a slice thickness of 1 cm. CSA of for the muscle heads and for the whole muscle was measured at each scan. The largest CSA of the QF and the largest summed CSA (sCSA) (sum of the largest CSA of the heads) was determined, then physiological cross-sectional area (PCSA) and summed PCSA (sPCSA) was calculated by using average muscle fibre length. Maximum isometric torque was measured by MULTI-CONT dynamometer and the muscle force was calculated by using average moment arm. Stress values was determined for CSA, sCSA, PCSA and sPCSA and compared.

The force calculated for QF was 6876.2 ± 569.9 N. The CSA, sCSA, PCSA and sPCSA values were 85.7 ± 8.7 cm², 110.8 ± 13.8 cm², 126.8 ± 13.1 cm², 162.0 ± 20.3 cm², respectively. The differences are significant. The PCSA was the largest for VL (53.9 ± 7.3 cm²), and smallest for RF (25.4 ± 3.5 cm²). The stress values calculated for CSA, sCSA, PCSA and sPCSA were 80.75 ± 8.2 N/cm², 62.69 ± 7.6 N/cm², 54.59 ± 5.7 N/cm², 42.9 ± 4.3 N/cm², respectively. The stress values revealed in the present study are in the range that appeared in the literature. However, there are significant differences between values determined for different cross-sectional areas. The smallest value was found for sPCSA, which is still greater than that appears in the literature and used for theoretical calculations by the researcher (30 N/cm²). This deviation can be attributed to the difference in the magnitude of the force generated by the subjects in different studies. Also, the length of the muscle fibres used for the calculation influences the stress values. We concluded that further, more precise measurement is needed to learn if the stress for different muscles is uniform and to obtain valid and reliable value.

Key-words: knee extensors, cross-sectional area, muscle length, stress, magnetic resonance image

Introduction

The maximum force has been believed to be linearly proportional to the cross sectional area of the muscles since 1846 (Weber). Several studies were done to verify this assumption. Since modern, sophisticated equipment has been available, such as ultrasonograph, computer tomography and magnetic resonance image, numerous researchers attempted to estimate the force calculated for unit muscle cross-sectional area in vivo (Ikai and Fukunaga 1968, Maughan et al. 1983, 1984, McCullagh et al., Narici et al. 1988, 1989, 1992). The force expressed for unit cross-sectional area is called stress or specific tension. The stress values of the human skeletal muscle vary largely because of the great difference in the measured force and in determination of the cross-sectional area. The stress values that appeared in the literature varied from about 20 Ncm² to 100 N cm². Because the muscle architecture is different (different arrangement of the fibres) the force should be directly proportional to the physiological cross-sectional area (PCSA) but not to the anatomical cross-sectional area (CSA). It is widely accepted that the specific tension (force related to PCSA) for muscles in general varies between 16-40 (Edgerton et al. 1990, Kanda and Hashizume 1992, Nygaard et al. 1983). Narici et al. (1988, 1992) carried out the calculation most precisely on quadriceps muscle. They found that the stress for the quadriceps femoris was 80.1 calculating the force for unit CSA (1988). Narici et al. 1989, 1992) calculated the stress values separately for the four muscle heads of the knee extensor muscle by using PCSA. They found that the stress values calculated for unit PCSA were different in the muscle heads and varied between 23.7 and 27.9 Ncm². There is a great difference between the results of their two studies that can be explained by the difference between CSA and PCSA. However, it should be noted that the pinnation angle of the muscle heads is small and as a consequence it does not influence so dramatically the PCSA compared to CSA. Moreover, it cannot be imagined that stress for the whole quadriceps muscle is three times greater compared to the muscle heads. Therefore the aim of this study was to reinvestigate the problem calculating the stress for the whole quadriceps muscle and separately for the individual heads in the same muscle.

Materials and Methods

Subjects

Eight healthy males volunteered for the study. The subjects had mean (±SD) age 26.6 ± 3.5 years, body weight 75.3 ± 8.2 kg and body height 174.4 ± 3.6 cm. All subjects were informed of all possible risks of the study and each subject signed an informed consent form that was approved by the University's ethical committee.

Determination of Knee Extensor Morphological Parameters Magnetic Resonance Imaging (MRI)

The subjects were lying supine with extended knee and relaxed quadriceps in a MR apparatus. MR scanned the dominant leg of the subjects. The duration of MR imaging was 20 minutes. MR scans of the knee and the thigh were performed on a 1.5T Siemens Vision Plus (Erlangen, Germany) whole body scanner. For the measurement of the cross-sectional area of the quadriceps femoris we made transverse slices of the whole thigh, from the origin of the rectus femoris (RF) to the apex of the patella. Sequence parameters of the used spin-echo method were as follows: TR: 1000 ms; TE: 17 ms; Flip angle: 90; Matrix: 192x256; Field of view: 250 mm; slice thickness: 10 mm.

Measurement of the Anatomical Cross-sectional Area (CSA)

MR images were exported as DICOM images and post-processing work was done in a PC environment (Osiris). CSAs of individual heads of the extensor muscles were measured by computer-aided planimetry (OSIRIS). Cross-sectional area of vastus lateralis (VL), medialis (VM), intermedius (VIM) and rectus femoris (RF) was measured at each image and summed (Figure 1). To determine the largest cross-sectional area of the quadriceps muscle we selected that slice at which the CSA of the quadriceps muscle was the largest (Figure 2). Because the largest CSA for the individual muscle heads can be measured at different length of the quadriceps muscle, we also calculated the largest CSA for the quadriceps femoris by summing the largest CSA of each heads (Figure 3) that has been called summed CSA (sCSA).

Calculation of the length of the individual muscle heads

The length of the muscle heads was estimated by counting the number of the 10 mm thick slices. The number of the slices gave the length of the muscle heads with an error of 5 mm. Also the length from the distal end of the muscle heads to the largest CSA was estimated.

Calculation of muscle volume

First we calculated the volume of the slices for each muscle head as follows

$$V_{s(VL, VM, VIM, RF)} = [(As_1 + As_2) / 2] \square l_s$$

Where V_s is the volume of one slice for vastus lateralis (VL), vastus medialis (VM), vastus intermedius (VIM) and rectus femoris (RF) muscle heads, A_1 and A_2 are the CSA for the neighbouring two slices, and l_s is the thickness of one slice, i.e. 10 mm.

The total volume (V) of the muscle heads was the sum of the volume of V_s , namely

$$V_{(VL, VM, VIM, RF)} = S V_s$$

Muscle fibre length (Lf)

The calculation of PCSA fibre length was taken from the literature (Rutherford and Jones 1992, Roy and Edgerton 1992, Yamaguchi et al. 1990, Wickiewicz et al. 1992). The averaged fibre length was 66 mm for VL and RF muscle heads, 68 mm for VIM and 70 mm for VM.

Calculation of the physiological cross-sectional area (PCSA)

PCSA of each head was calculated by the formula suggested by Alexander and Vernon (1975), i.e.

$$PCSA_{(VL, VM, VIM, RF)} = V / L_f$$

where V is the volume of the muscle and L_f is the average length of the muscle fibre in each muscle head.

The PCSA of the quadriceps femoris was calculated by summing the PCSA of the individual muscle heads determined either at that length where the CSA was the largest for quadriceps muscle or at the largest CSA (sCSA) for each muscle head.

Measurement of the torque for knee extensors

Instrumentation. A custom-built computer-controlled dynamometer (Multicont II, Mediagnost, Budapest and Mechatronic Kft, Szeged, Hungary) was used to collect torque-time, joint position-time, and angular velocity-time data during knee extension. An electric servo-motor (Mavilors AC Servo-motor, M10, Spain) controlled the dynamometer's stainless steel lever arm (600 x 50 x 10 mm). The measuring unit of the dynamometer comprises three main components. 1. The servo motor is an AC flat sinusoidal brushless motor manufactured by Mavilor Motors in Spain (Type: MA-10, maximum speed: 6000 rpm, maximum continuous torque: 5.8 Nm, short term peak torque: 40.7 Nm). 2. The gear drive is a backlash free compact cyclo drive manufactured by Lorenz Braren GmbH in Germany (Type: FAD 25, reduction ratio: 59, rated output torque: 460 Nm, maximum short term output torque: 971 Nm). 3. The load cell is a custom designed unit designed and manufactured specifically for this application. It is similar to two disks connected to each other by eight radially positioned thin ribs. It is made of high tensile strength steel and due to its unique shape it is sensitive only to torque loads. There are four strain gauges glued to the flexible ribs of the load cell (Sensitivity: 0.5 Nm, maximum torque: 500 Nm).

Procedure. The subjects were familiarized with the experimental procedure. They performed unilateral knee extensions in sitting position, with a reclined and fixed seat and back (hip joint angle was 110 degrees), and the rotational axis of the knee joint was aligned with the input axis of the dynamometer. The leg was firmly attached to the lever arm (10 mm thick, 50 mm wide and 400-600 long) made of steel. To prevent hip extension during maximum effort the thighs, the pelvis and the chest were fixed to the leg rest and back support of the seat. The subjects had a ten minute warming up session including running, stretching and knee extensions prior to test. Maximum voluntary isometric contraction was measured three times at 40, 60 and 80 degrees of knee angle separated by two-minute rest interval. The highest value from the three trials that was measured at the three joint angle positions was chosen for further calculations.

Calculation of force

The maximum isometric force was calculated on the basis of moment equilibrium as follows

$$F = M / l_p$$

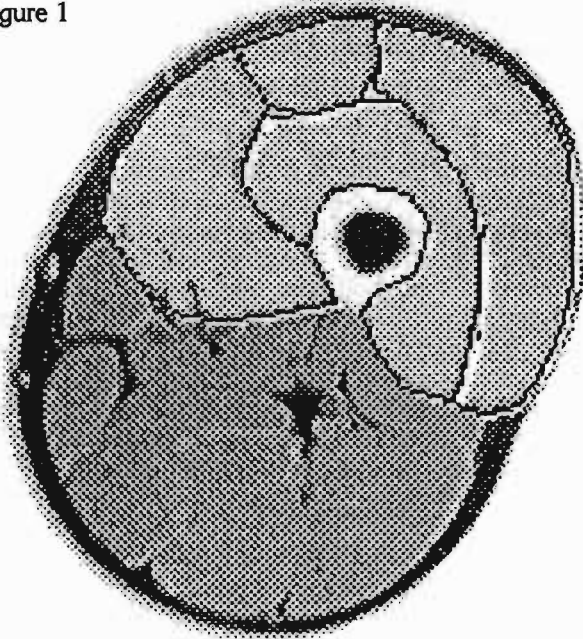
Where M is the measured torque and l_p is the moment arm of the patellar tendon. The moments arm was obtained from Smidt (1973) study that was 45 mm at that particular knee joint angle position where we measured the maximum isometric torque value for each subject.

Calculation of the force for each muscle heads

Because the force is linearly related to the cross-sectional area of the muscle head the ratio of the force production of those is similar to the ratio of the cross-sectional area of the four muscle heads. Therefore, first the percentile ratio of the CSA and PCSA for each head was calculated as follows:

$$\%CSA_{(VL, VM, VIM, RF)} = (CSA_{(VL, VM, VIM, RF)} / CSA_q) \square 100$$

Figure 1



Magnetic resonance image (MRI) of the thigh. The figure shows the anatomical cross-sectional area (CSA) of the four heads of quadriceps femoris determined at that muscle length where the largest CSA for the whole quadriceps muscle was found

where CSA_q is the anatomical cross-sectional area of the quadriceps femoris.

$$\%PCSA_{(VL, VM, VIM, RF)} = (PCSA_{(VL, VM, VIM, RF)} / PCSA_q) \square 100$$

where PCSA_q is the physiological cross-sectional area of the quadriceps femoris.

Then the isometric force was calculated for the muscle heads as follows

$$F_{1(VL, VM, VIM, RF)} = (F \square \%CSA_{(VL, VM, VIM, RF)}) / 100$$

and

$$F_{2(VL, VM, VIM, RF)} = (F \square \%PCSA_{(VL, VM, VIM, RF)}) / 100$$

Where F is the maximum isometric force of quadriceps femoris, F_{1(VL, VM, VIM, RF)} is the isometric force of each muscle heads calculated on the basis of CSA, F_{2(VL, VM, VIM, RF)} is the isometric force of each muscle heads calculated on the basis of PCSA.

Calculation of the stress (specific tension)

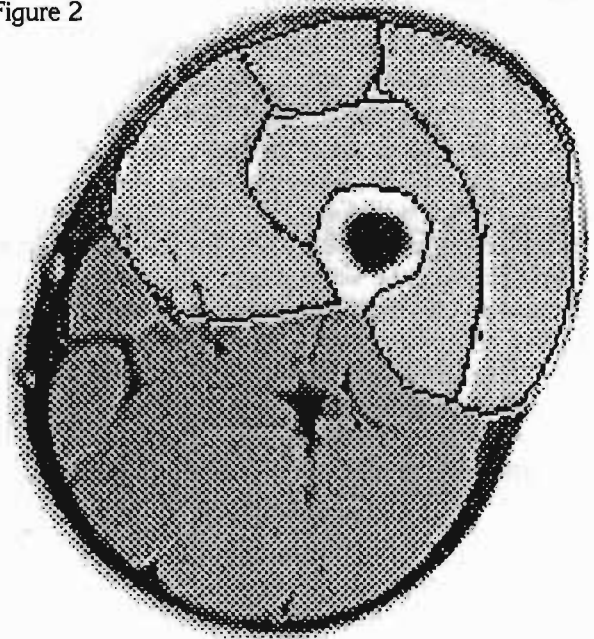
The stress was calculated by using either CSA or PCSA for the each muscle head as follows:

$$F_{s1(VL, VM, VIM, RF)} = F_{1(VL, VM, VIM, RF)} / CSA_{(VL, VM, VIM, RF)}$$

and

$$F_{s2(VL, VM, VIM, RF)} = F_{2(VL, VM, VIM, RF)} / PCSA_{(VL, VM, VIM, RF)}$$

Figure 2



The largest anatomical cross-sectional area of the quadriceps femoris muscle (QF) measured

Also, the stress was calculated for the whole quadriceps femoris muscle by summing the stress (specific tension) of the four muscle heads.

Statistical analysis

Mean and standard deviation (SD) was calculated for each parameter. The means were compared by applying un-paired, one-tailed Student t-test. The difference between two means was considered to be significant at p < 0.05.

Results

The largest CSA of quadriceps femoris muscle (85.7±8.7cm²) was found at a muscle length of 20.7±2.6 cm in average. At this length the VL, VM, RF and VIM contributed to the CSA with 39.7%, 14.5%, 13.39% and 32.23%, respectively. However, when we take the largest CSA₂ of each individual head, which was found at different length of the quadriceps muscle the sCSA was 29.3 % larger (110.8±13.8cm²) as compared to CSA (Figure 4).

The largest PCSA of quadriceps femoris was 126.8±13.1 cm². The contribution of each head to PCSA was 38.8% for VL, 15.5% for VM, 13.0 % for RF and 34.1 % for VIM. The sum of the PCSA of the four heads we obtained a value of 162.0±20.3cm², that is 27.8 % larger than PCSA. Table 1

| Table 1. | VL | VM | RF | VIM |
|--------------------------------------|--------------|--------------|--------------|--------------|
| CSA ₁ (cm ²) | 34.1 ±4.5 | 12.4 ±0.6 | 11.5 ±2.1 | 27.6 ±5.1 |
| CSA ₂ (cm ²) | 36.0 ±4.9 | 28 ±4.0 | 17.1 ±2.3 | 29.8 ±5.5 |
| CSA ₁ ratio to CSA (%) | 39.7 | 14.5 | 13.4 | 32.2 |
| CSA ₂ to sCSA (%) | 32.4 | 25.3 | 15.4 | 26.8 |
| PCSA ₁ (cm ²) | 49.3 ±7.9 | 19.6 ±4.9 | 16.2 ±3.5 | 43.2 ±8.2 |
| PCSA ₂ (cm ²) | 53.9 ±7.3 | 39.5 ±5.9 | 25.4 ±3.5 | 41.7 ±7.0 |
| PCSA ₁ ratio to PCSA | 38.8 | 15.5 | 13.0 | 34.1 |
| PCSA ₂ ratio to sPCSA | 32.2 | 24.4 | 15.7 | 25.7 |

| | VL | VM | RF | VIM | QF |
|---------------------------|------------|------------|----------|----------|------------|
| Length (cm) | 33.3±3.2 | 30.3±3.3 | 30.8±105 | 33.5±2.2 | 38.4±2.1 |
| Length at sCSA (cm) | 19.0±2.7 | 9.0±1.8 | 19±2.4 | 17.4±1.7 | 20.7±2.5 |
| Length % at CSA | 57.0% ±5.7 | 29.6% ±4.4 | 65.9% ±9 | 52.0% ±5 | 53.7% ±5.7 |
| Volume (cm ³) | 7.6 ±1.1 | 4.6 ±0.7 | 3.1±0.3 | 6.1 ±1.2 | 23.0 ±3.1 |

| | VL | VM | RF | VIM |
|-----------------------------|------------------|------------------|------------------|------------------|
| F ₁ at CSA (N) | 2731.3 ±322.2 | 1004.8 ±124.5 | 927.5 ±209.2 | 2203.0 ±285.5 |
| F ₁ at sCSA (N) | 2378.5 ±523.0 | 1739.5 ±203.9 | 1062.6 ±127.7 | 1838.5 ±234.6 |
| F ₂ at PCSA (N) | 2657.5 ±260.4 | 1086.6 ±357.6 | 876.3 ±171.5 | 2255.7 ±323.0 |
| F ₂ at sPCSA (N) | 2290.7 ±262.0 | 1677.9 ±204.2 | 1082.8 ±131.7 | 1824.7 ±240.1 |

shows the CSA, sCSA, PCSA and sPCSA values and their percentile ratio to the respective CSA of the quadriceps muscle. The PCSA of each muscle head is significantly greater than their CSA. The VL and VIM muscle heads have the largest CSA₁ at CSA, but VM and VIM have similar CSA₁ at sCSA. Similarly, The VM contribute to the CSA, sCSA, PCSA and sPCSA with the highest percentage but their contribution to the sCSA and sPCSA decreases.

Table 1. CSA₁ is the cross-sectional area for the individual heads measured at that level where the CSA is the largest for the whole quadriceps muscle. CSA₂ is the largest area of the individual heads at different muscle length. PCSA₁ is the cross-sectional area for the individual heads measured at that level where the CSA is the largest for the whole quadriceps muscle. PCSA₂ is the largest area of the individual heads at different muscle length. The CSA and PCSA of the individual heads were compared either to the maximum cross-sectional area of the quadriceps muscle or the sum of the largest cross-sectional area of each head.

The length of the four muscle heads is similar ranging between 30.3 and 33.5 cm (**Table 2**). Because the origin and insertion of the four heads can be found at different length of the thigh, the length of the muscle is greater than the length of the individual muscle heads. The largest CSA of VM is the nearest to the insertion as compared to the other three muscle heads. The greatest CSA for RF is nearer to the origin than to the insertion. The largest CSA for VM, VIM and the whole quadriceps muscle is around 50 %. Concerning muscle head volume, the largest muscle head is the VL and the smallest is the RF.

Table 2. The table shows the length (cm) and the percentile length (%) of the four heads and the whole quadriceps at CSA. The length is the distance of the CSA from the distal transition of each head from muscle tissue to the quadriceps tendon. Volume (cm³) of each individual head and of the whole quadriceps muscle is also presented. The numbers indicate the means and their standard deviation (±).

The maximum isometric torque exerted by the knee extensors was 309.4± 25.6 Nm. The maximum isometric force calculated on the basis of torque equilibrium was 6876.2 ± 569.9 N. The isometric force was also calculated for each individual head using maximum CSA and PCSA and the sum of the maximum CSA and PCSA (**Table 3**).

Because the force generated by each muscle head individually was calculated on the basis of the cross-sectional area ratio, it is not surprising that VL contribute with the

highest extent to the total force of the quadriceps muscle. The RF muscle head has the lowest share from the total force. The MV and VIM muscle exert similar magnitude of force when the force was calculated on the basis of the largest CSA of each head.

Table 3. Isometric force of each individual head of quadriceps muscle CSA, sCSA, PCSA, and sPCSA. The numbers indicate means and their standard deviation (±)

Significant difference was observed between stress (specific tension) values of the quadriceps femoris muscle when comparing CSA (80.75 ± 8.2 N/cm²) and sCSA (62.69 ± 7.6 N/cm²), as well as PCSA (54.59 ± 5.7 N/cm²) and sPCSA (42.9 ± 4.3 N/cm²). Also, the stress was significantly greater when the force was calculated for unit anatomical cross-sectional area in comparison to stress calculated for unit PCSA. CSA and sCSA was 1.46 times greater than PCSA and sPCSA, respectively, because the force generated by the four muscle head jointly and it was calculated on the basis of area ratio, the stress should be equal to the stress of the whole quadriceps femoris. The only factor, which can change the physiological cross-sectional area, is the pinnation angle. However, the area ratio of the four heads remains constant, so that the stress should be identical.

Discussion

The force generated by the muscles cannot be measured directly. In vivo, the torque production is measured first then having learned the moment arm of the quadriceps, the force can be calculated. It is widely accepted that the maximum force, which can be generated by a muscle is directly proportional to its cross-sectional area (Knuttgen 1976, Maughan et al. 1983). However, the fibre arrangement in the muscles is different altering the real cross-sectional area of the muscle, because the cross-section should always be perpendicular to the muscle fibre pulling line. That is the reason why the anatomical cross-sectional area is equal only to the so-called physiological cross-sectional area in the parallel-arranged muscles. The stress calculated for unit anatomical CSA in a pinnated muscle is always greater than the stress calculated for PCSA (Narici et al. 1988, 1989). Also, it is important to determine the largest cross-sectional area of the muscle that varies along the muscle length (Fukunaga et al. 1991, Narici et al 1992). Because of the difference in muscle force and cross-sectional area measurement methods, the stress calculated for different muscle varies largely between 20 and 100 N/cm².

The quadriceps femoris muscle is the largest extensor muscle in the human body having four heads in which the

fibres have different pinnation angle to the line of the pull of their heads (14.0—17.0- for VL, 15.1—16.0- for VIM), and to the whole muscle (Wickiewicz et al. 1983, Yamaguchi et al. 1990, Narici et al. 1992). This fact indicates that the CSA and PCSA for the muscle heads and for the whole quadriceps should be different.

The CSA for quadriceps femoris ranged between 42 and 110 cm² (Tsunoda et al. 1985, Mc Cullagh et al. 1983, Wickiewicz 1984, Narici et al. 1988). In our study, the CSA was 85.6 cm² that is similar to those values, which were estimated at the largest CSA of the quadriceps muscle in vivo by using MRI. The summed CSA (sCSA) has not been presented in the literature. Comparing the CSA and sCSA obtained in our study the sCSA was 110.8 cm² that is 29.4 % larger than CSA. Concerning PCSA of the whole muscle presented in this study was 126,7 cm² that is 14.3 % greater than CSA of the whole muscle. The sPCSA was 162.0 cm² that is considerable less than the value (280.1 cm²) presented by Narici et al. (1992). The great difference between the result of ours and Narici et al. can be explained by several facts.

The calculation of the physiological cross-sectional area was different. Namely, Narici et al. (1992) calculated the PCSA as follows: the product of muscle mass and pinnation angle was divided by the product of average muscle fibre length and muscle density, whereas in our study muscle volume was divided by muscle fibre length. Basically the two calculations should result in similar value. Consequently the discrepancy between Narici et al. (1992) and our result can be attributed to other facts.

The pinnation angle determined for the four heads by Narici et al. (1992) was considerably larger than those obtained by Yamaguchi et al. (1990) and Rutheford and Jones (1992). It is apparent from the formula they used the greater the pinnation angle the greater the PCSA is. Also, the pinnation angle influences the volume positively if the length of the muscle head remains constant. However, when comparing the volume of each muscle head found by us and Narici et al. (1992) the total volume of quadriceps and the individual heads, our values were considerable greater than those of Narici et al. (1992). This difference can be attributed to the difference in the accuracy of the measurement of CSA. We carried out 40 axial MRI images of the thigh in contrast with Narici et al. (1992) who calculated the muscle volume carrying out only twelve MR axial images. However, the vast difference in PCSA cannot be attributed only to the different muscle volume. Narici et al. (1992) found that the muscle fibre length ranged between 22 and 35 mm. These values were only half or even less than the values published by Lieber et al. 1990, Rutheford and Jones 1992, Roy and Edgerton 1992, Yamaguchi et al. 1990, Wickiewicz et al. 1992.

The maximum isometric force determined for the knee extensors in our study is similar to that presented by Narici et al. (1988, 1992). Because there is great difference between the CSA and PCSA values found in the present study and in the above mentioned papers, no surprise that there is considerable difference in stress values, too. Comparing the stress calculated for either CSA or sCSA the values decreased significantly for VL and VIM, and increased for RF and VM. These alterations can be attributed to that observation that the anatomical cross-sectional area was the largest for each muscle head at different length of the muscle (Figure 4). The largest CSA for VM was found more distal, whereas the largest CSA for RF was more proximal. The largest CSA for VM and VIM was near to the middle of

the muscle head belly. In most of the cases none of the four heads had the largest CSA at that muscle length where the largest CSA was estimated for the quadriceps muscle. Assuming that the force generation of each muscle directly correlates with the largest PCSA, it is apparent that the force production of each muscle head is proportional to the physiological cross-sectional area ratio of the four heads. Indeed, the highest contribution to the total force of the quadriceps is due to the VL and VIM. RF generated the least force.

The stress calculated for CSA was 80.7±8.2 N/cm² that is similar to the values presented earlier (McCullagh et al. 1983, Narici et al. 1988). This value is 28.8 % greater than sCSA (62.7±7.6 N/cm²) estimated in our study. The stress calculated for PCSA is significantly lower than CSA and sCSA. The sCSA value observed in this study is similar to the first published value estimated from ultrasound measurement by Ikai and Fukunaga (1968). However, the two calculations are different, because Ikai and Fukunaga (1968) used CSA instead of PCSA. Narici et al. (1992) found that the stress was different for the four muscle head that ranged between 24.1 and 27.9 N/cm². The great difference between the calculated values is due to the difference in the applied muscle fibre length.

The results of the present study indicate that the anatomical cross-sectional area should be carefully measured and for the calculation of the physiological cross-sectional area should be precisely done. Despite the use of modern devices (ultrasound, MR, CT) and careful measurement and calculation, the stress values vary within a large range. The question arises as to whether the pinnation angle and fibre length can be so different for the human quadriceps femoris. It is not probable that the muscle length for quadriceps muscles can alter extremely. Let us assume that the diameter of the rectus femoris muscle is two cm and the pinnation angle is 15 degrees (Alexander and Vernon 1975, Gans 1982, Wickiewicz et al. 1983, Edgerton et al. 1986). Knowing these two variables the fibre length can be calculated as follows

Fibre length = diameter (2 cm) / sin pinnation angle (15°).

Then the fibre length is 7.7 cm, which is similar to those published earlier (Rutheford and Jones 1992, Roy and Edgerton 1992, Yamaguchi et al. 1990, Wickiewicz et al. 1992, Brand et al. 1986). Supposing that this calculation is correct then the muscle length cannot be 3.5 cm, which is the estimated fibre length in the study of Narici et al. (1992). Accepting this assumption, then we may conclude that the stress calculated by Narici et al. (1992) is underestimated. As a conclusion, we may state that the stress value found in our study is more realistic. However, it should be noted that the pinnation angle changes when the muscle contracts. Similar to the other researcher, we used pinnation angle that was determined in relaxed muscle. We know that when a muscle exerts maximum isometric force, the length of the fibres decreases and consequently the length of the muscle decreases, too. Supposing that the diameter of the muscle remains constant then the pinnation angle should increase.

Let us assume that the muscle fibre length decreases by 10 %. Then the pinnation angle increases by 1.8°. Because the volume of the muscle during contraction does not change and we use the formula applied in our study then the PCSA will be 44.5 cm² for the RF that is greater with 4.6 cm² than the PCSA in relaxed muscle. Because the force generated by the muscle is the same, the stress decreases. The stress for a muscle has been exclusively calculated

under isometric contraction so far. However, the muscle can generate greater force under eccentric contraction than under isometric contraction. When the force for a muscle increases then the stress also increases. Consequently, the stress should be higher than that has been calculated for the muscle in the studies carried out on muscles *in vivo*.

Summarising the findings of the present study, we may conclude that the stress calculated for physiological cross-sectional is between 40 N/cm² and 50 N/cm², which is significantly less than the stress calculated for anatomical cross-sectional area, but considerably greater than the stress value found by Narici et al. (1992) using the same methods and calculations. To determine the stress of the muscles, reliable and even more precious studies should be carried out by applying not only isometric but eccentric contraction, too.

References

1. Alexander, R.M., Vernon, A. (1975) The dimensions of knee and ankle muscles and the forces they exert. *Journal of Human Movement Studies*, 1:115-123.
2. Brand, R.A., Pedersen, D.R., Friederich, J.A. (1986) The sensitivity of muscle force predictions to changes in physiological cross-sectional area. *Journal of Biomechanics*, 19:589-596.
3. Edgerton, V.R., Bodine, S.C., Roy, R.R. (1987) Muscle architecture and performance: Stress and strain relationships in a muscle with two compartments arranged in

series. In: P. Marconnet and P.V. Komi (eds) *Medicine and Sport Sciences: Muscular Function in Exercise Training*. Vol. 26, pp. 12-23. Karger, Basel.

4. Edgerton, V.R., Apor, P., Roy, R.R., (1990) Specific tension of human elbow muscles. *Acta Physiologica Hungarica*, 75:205-216.

5. Fukunaga, T., Roy, R.R., Shellock, F.G., Hodgson, J.A., Lee, P.L., Kwong-Fu, H., Edgerton, V.R. (1991) Physiological cross-sectional area of human leg extensor muscle based on magnetic resonance imaging. *Journal of Orthopaedic Research*, 10:926-934.

6. Gans, C. (1982) Fibre architecture and muscle function. *Exercise and Sport Sciences Reviews*, 10:160-207.

7. Hakkinen, K., Keskinen, K.L. (1989) Muscle cross-sectional area and voluntary force production characteristics in elite strength-trained and endurance-trained athletes and sprinters. *European Journal of Applied Physiology*, 59:215-220.

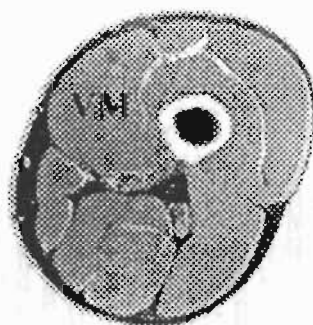
8. Ikai, M., Fukunaga, T. (1968) Calculation of muscle strength per unit cross-sectional area of human muscle by means of ultrasonic measurement. *Int Z. angew. Physiology*, 26:26-32.

9. Kanda, K., Hasizume, K. (1992) Factors causing difference in force output among motor units in the rat medial gastrocnemius muscle. *Journal of Physiology*, 448:677-695.

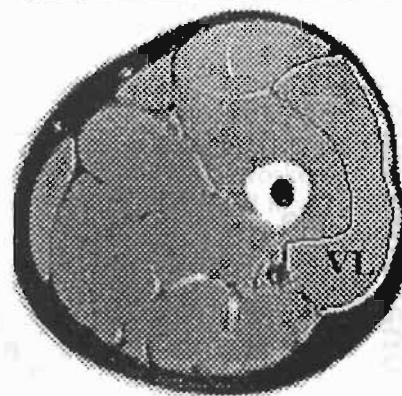
10. Lieber, R.L., Fazeli, B.M., Botte, M.J. (1990) Architecture of selected muscles of the arm and forearm. *Journal of Hand Surgery*, 15A:244-250.

Figure 3

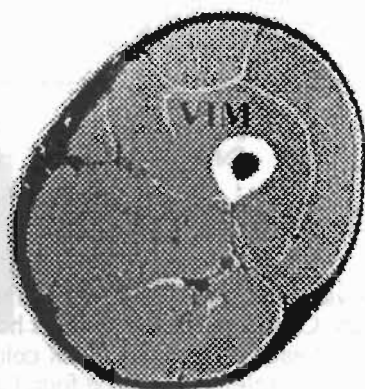
The figure shows the largest anatomical cross-sectional area (CSA) for vastus medialis (VM), vastus lateralis (VL), vastus intermedialis (VIM) and rectus femoris (RF) muscles. Note that the largest CSA for the individual muscle heads was found at different muscle length. The sum of the largest CSA of the four heads resulted in the summed CSA (sCSA)



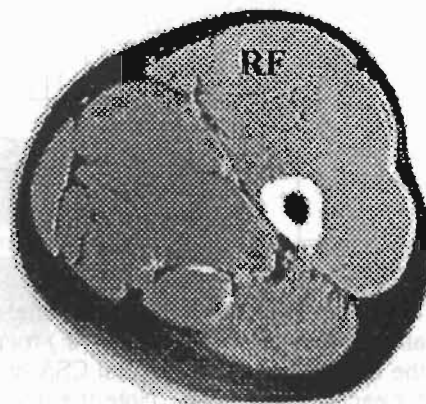
Vastus medialis



Vastus lateralis



Vastus intermedialis



Rectus femoris



Dietary Habits of Second-Year Medical Students

Másodéves orvostanhallgatók étkezési szokásai

Lajos Ángyán, Klára Cs. Tolnai and Tamás Téczy

Institute of Human Movement Sciences, Medical School, University of Pécs,
Pécs, Hungary

Abstract

The life style of medical students affects both the maintenance of their own health and the training of the prevention-oriented behaviour of the future physician. Nutrition is an integral part of life style; therefore, the purpose of this pilot study was to examine the dietary habits of medical students. Second-year medical students were asked to complete a questionnaire. A total of 38 of 50 returned the completed questionnaire. The respondents self-estimated the composition of their own diets, the types and the times of the meals. More than 60% of the respondents believe that their own nutrition knowledge is sufficient. It was found that 50% of women and 40% of men consume a mixed menu; the others choose foods of increased carbohydrate, protein or dietary fat components. Men eat more meat than women, while women prefer milk products and fruits. None of them is vegetarian. They drink coffee and alcohol, generally, by chance. Hot meals are

preferred as the midday meal, the breakfast and the evening meals are generally cold food. About two-thirds of men, and half of the women habituated three meals daily; however, the breakfast is often dismissed. Nearly, 50% of the respondents choose small meal sizes, and, on the contrary, 20% of them prefer Epicurean meals. The dietary habits of medical students are behind the best for their health. Medical education should include more emphasis on medical students' healthy life style.

Key-words: dietary habits, life style, medical students, nutrition knowledge

Összefoglaló

Az orvostanhallgatók életmódja nemcsak a saját egészségükre hat, hanem a leendő orvos egészségmegőrző magatartására is. Miután a táplálkozás az életmód egyik fontos összetevője, próba felmérést végeztünk az orvostanhallgatók étkezési szokásainak a megismerése céljából. Másodéves orvostanhallgatókat kértünk meg az ál-

talunk összeállított kérdőív kitöltésére. 50 kérdőívből 38-at töltöttek ki. A válaszolók ismertették a saját étrendjüket, ételleik összetételét, s az étkezések időpontját. Mintegy 60%-uk megfelelőnek tartja a saját táplálkozástani ismereteit. A nők 50%-a, a férfiak 40%-a táplálkozik vegyesen, a többiek szénhidrátbő, fehérjében gazdag, vagy zsírbő ételeket fogyasztanak. A férfiak több húst esznek, a nők előnyben részesítik a tejtermékeket és a gyümölcsöt. Vegetáriánus nincs közöttük. Rendszeresen fogyasztanak kávét és alkoholt. Ebédre általában főtt ételeket, reggelire és vacsorára pedig többnyire hideg ételeket esznek. A férfiak kétharmada, a nők fele naponta háromszor étkezik; a többiek leggyakrabban a reggelit hagyják el. A válaszolók fele keveset eszik, szemben a mintegy 20%-al, akik bőségesen étkeznek. A felmérés eredményei szerint az orvostanhallgatók étkezési szokásai elmaradnak a kívánatostól. Adataink azt mutatják, hogy az orvosképzés során nagyobb figyelmet kell fordítani az orvostanhallgatók egészséges életmódjára.

Kulcsszavak: életmód, étkezési szokások, orvostanhallgatók, táplálkozástani ismeretek

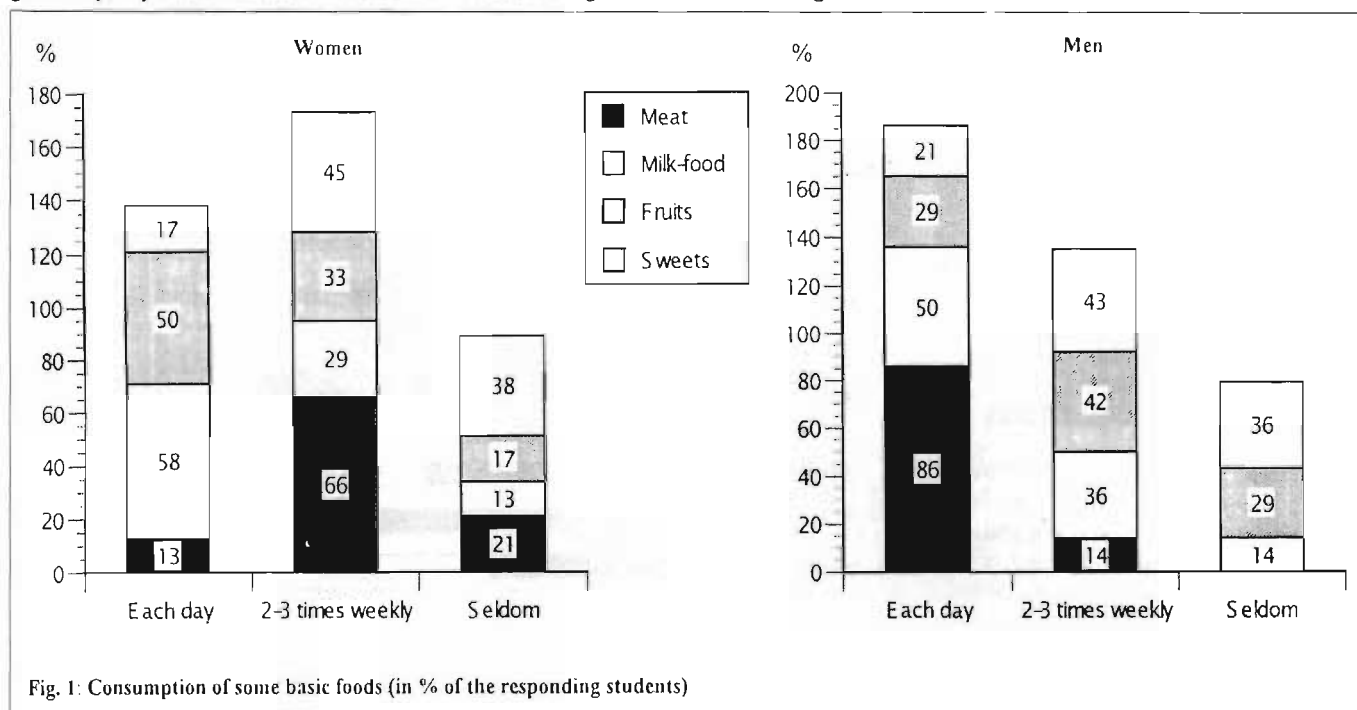


Fig. 1: Consumption of some basic foods (in % of the responding students)

Table 1: Self-estimation of the diet (% of the total respondents).

| | Mixed | Rich carbohydrate | Rich fat | Rich protein | Vegetarian | Poor |
|-------|-------|-------------------|----------|--------------|------------|------|
| Women | 50 | 17 | 0 | 16 | 0 | 17 |
| Men | 40 | 10 | 7 | 36 | 0 | 7 |

Table 2: Occurrence of alcohol intake and smoking (% of the total respondents).

| | Alcohol | | | Smoking | | |
|-------|---------|-----------|-------|---------|-----------|-------|
| | Never | By chance | Daily | Never | By chance | Daily |
| Women | 13 | 58 | 29 | 66 | 17 | 17 |
| Men | 0 | 79 | 21 | 86 | 7 | 7 |

Introduction

The life style of medical students deserves attention for two reasons: first, from the point of view of the maintenance of their own health, and, second, in terms of the prevention-oriented behaviour of the future physicians who should set a good example for his/her patients, and, give appropriate advice to healthy and ill people. The question rises whether the university studies induce beneficial changes in the medical students' life style, or other factors suppress their professional knowledge. Regular physical activity and nutrition are integral parts of the life style. It was found in our exploratory study that 20% of women and 40% of men do some kind of physical training (unpublished data). These findings stimulated a series of measurements to examine the physical condition of the students. The results of this investigation will be published in another article. The aim of the present study was to obtain information about the dietary habits of medical students. There is a considerable effort to involve nutrition sciences in medical education^{1, 2, 3, 4}. It is believed that the involvement of nutrition subjects in the curriculum facilitates the development of healthy dietary habits. In our faculty there are no special nutrition courses, but many nutrition topics are discussed within both the theoretical (biochemistry, physiology etc.) and clinical (internal medicine, pediatrics etc.) subjects of the curriculum. This pilot study of the dietary habits of medical students is an attempt to explore the factors that are influencing their nutrition.

Subjects and Methods

The subjects were second-year medical students of 20±2 years old. They were asked to complete a questionnaire of 75 questions at the end of the academic year. The main areas included in the questionnaire were university obligations, recreation and sleeping, nutrition, sports activities, sexual life, circumstances of life and self-estima-

tion. The students took the questionnaire home, so they had enough time to give well-considered answers. A total of 38 of 50 questionnaires were returned by the students. The unresponsive students were either disinterested or have forgotten to give back the questionnaire. The present paper summarises the answers to the questions related to the dietary habits. These questions inquired about understanding healthy diet, foods, food patterns, eating and meal habits.

Results

Close to 60% of the students who responded considered their own nutrition knowledge as sufficient. However, the estimation of the questions related to their diet failed to verify the use of this comprehension. As it is shown in Table 1, 50% of the women and 40% of the men consume mixed diet (i.e. around 50% carbohydrates, 30% protein and 20% fat). It appeared that 36% of the men are carnivorous, and 7% of them eat rich dietary fat (mainly bacon). None of the respondents is vegetarian. Seventeen percent of the women and 7% of men categorise their own diet as poor both quantitatively and qualitatively. It is shown in Fig. 1 that men consume meat (mostly mammal) each day, while women pre-

fer milk products and fruits. It is interesting that both women and men eat sweets (cakes, chocolate, etc.) in a similar amount. The daily fluid intake is between 1 and 1,5 L for 54% of women and 29% of men, while 33% of women and 71% of men drink more than 1,5 L/day. Considering the popularity of coffee-drinking, it is interesting that only about one third of the responding students consume coffee or coke each day. The occurrence of alcohol intake and smoking is shown in Table 2. The alcohol intake is mostly occasional among the respondents, but a relatively large number of students (29% of women and 21% of men) consume alcohol daily. The most popular (60%) alcohol is beer. It is also a warning sign that higher percent of women (17%) is than that of men (7%) smoke regularly.

The types of meals, more concretely the proportion of hot (fully cooked) meals and cold foods in a daily diet is shown in Table 3. It is noticeable that only about two thirds of the students consume hot meals even as midday meal.

The meal times are shown in Fig. 2. About two thirds of the respondents take meals three times daily, the others eat irregularly. Although the meal-sizes are different (Fig. 3), especially the small sizes of the breakfast and mid-

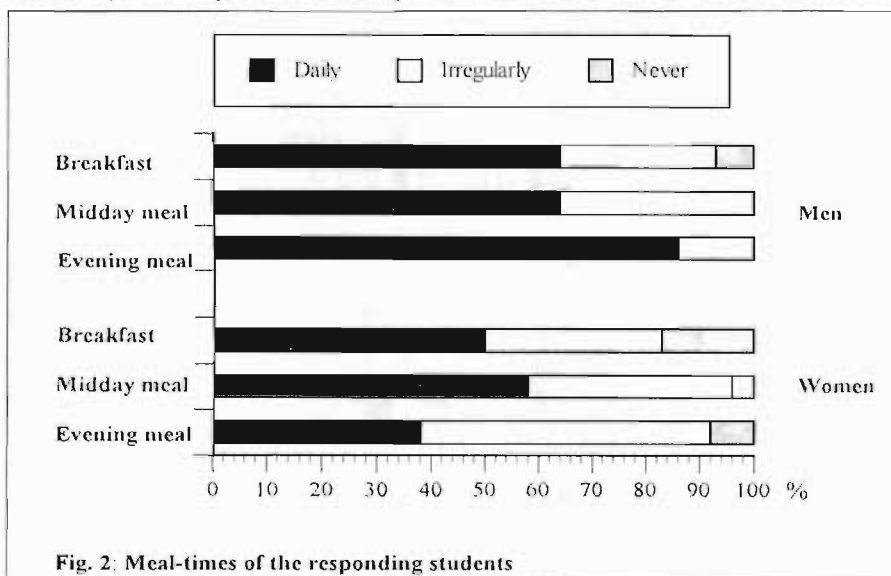
**Fig. 2: Meal-times of the responding students**

Table 3: Types of the midday and evening meals (% of the total respondents)

| | Midday meal | | | Evening meal | | |
|-------|-------------|-----------|----------|--------------|-----------|----------|
| | Hot meals | Cold food | Variable | Hot meals | Cold food | Variable |
| Women | 66 | 13 | 21 | 9 | 59 | 32 |
| Men | 64 | 7 | 29 | 14 | 65 | 21 |

Table 4: Financial situation of the medical students, and the eating expenses in % of the total cost of living

| | Excellent | Good | Average | Narrow | % |
|-------|-----------|------|---------|--------|----|
| Women | 5 | 25 | 50 | 20 | 31 |
| Men | 7 | 21 | 64 | 8 | 41 |

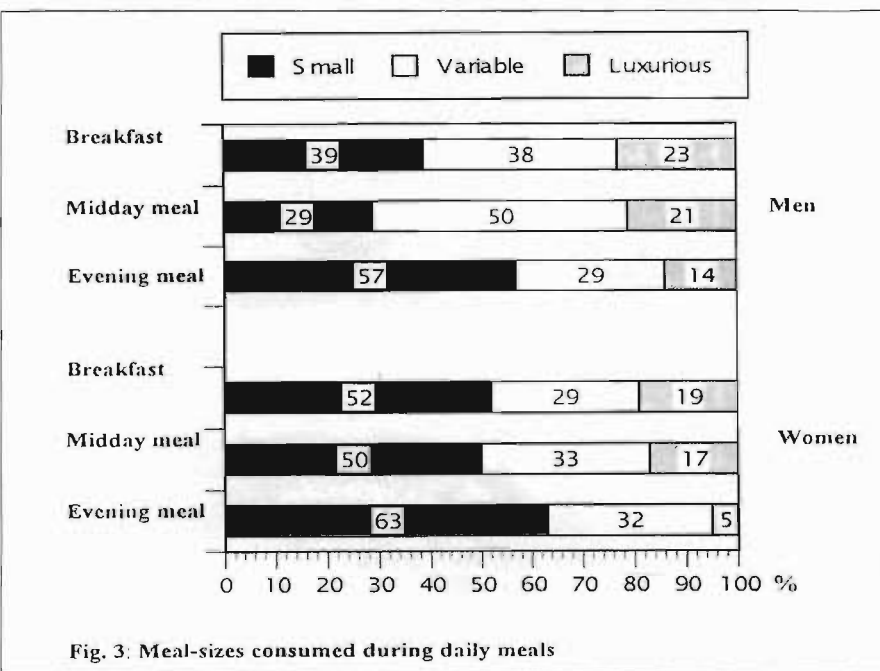


Fig. 3: Meal-sizes consumed during daily meals

day meals are behind the demands of a healthy diet.

The alimentation of the students is influenced by their resources. Most of the students estimated that their own financial situation as average. It is interesting that the highest % of the total living expenses is allotted to meals (Table 4).

Discussion

In a series of interviews made in our institute, it was revealed that the nutrition of medical students is determined by three main factors: 1. the tradition or habits, mainly of family origin; 2. the circumstances of life, including the weight of university obligations, and financial support; and 3. the nutrition knowledge (unpublished data). The effects of these factors are varying, they may strengthen or impair each other.

The present results show significant differences from both the traditions and the nutrition principles. The most important diversities are the irregular meal-times, the increase of cold foods in the daily diet, and the varying meal sizes. A possible assumption is that the dietary mistakes originate from the

current status of nutrition in the medical curriculum. A growing number of publications deal with the need for improvement of the medical curriculum^{5, 6, 7, 8, 9}. There is a tendency to include nutrition science in the medical core curriculum as a distinct subject¹⁰.

^{11, 12, 13, 14}. In fact, there are no special nutrition courses, but many nutrition topics are discussed within the theoretical (biochemistry, physiology etc.) and clinical (internal medicine, paediatrics etc.) subjects of our medical curriculum. In spite of these creative efforts in the present curriculum there remains a significant need for improvements in medical students' nutrition knowledge during the clinical studies to prepare them for effective medical counselling. A new requirement is aroused by translating food based dietary guidelines into culturally acceptable public health nutrition strategy in order to be understood by the general population^{15, 16, 17}.

However, there is another plausible explanation for the medical students' dietary habits. Namely, the vast amounts of university obligations interfere with healthy eating. The students cannot include reasonably the knowledge of healthy food in their daily diet, because of their full time-table: they must effectuate 360 credits during their six years university studies. Moreover, they have to sign up for some facultative courses, and do students' research work to obtain good qualifications. Therefore, the students cannot develop a biological rhythm of meals; they eat when they have time, and what they can get ready quickly. Also the short financial resources limit the dietary possibilities for some stu-



dents. Consequently, it would be an oversimplification to reduce the problems of medical students' dietary habits to their insufficient nutrition knowledge. The present results suggest that medical education should include more emphasis on medical students' healthy life style.

Acknowledgement: The grant NKFP 1/026, 2001 from the Hungarian Government, and a grant from the Hungarian Society of Sport Science supported this investigation.

References

1. Deen DD Jr, Karp RJ, Lowell BC. Contribution of regional networks to the nutrition education of physicians. *Journal of the American College of Nutrition*. 1996; **15**:413-417.

2. HarkL A, MorrisonG. Development of a case-based integrated nutrition curriculum for medical students. *The American Journal of Clinical Nutrition*. 2000; **72**:890S-897S.

3. Hu SP, Liu JF, Shieh MJ. Nutrition knowledge, attitudes and practices among senior medical students in Taiwan. *Journal of the American College of Nutrition*. 1997; **16**:435-438.

4. Warden RA, Lettoof AL, Wallis BJ, Porteous JE.. Feed us nutrition: final year medical students' perceptions of nutrition medical education. *Australian and New Zealand Journal of Medicine*. 1996; **26**:640-645.

5. Atkins KM, Roberts AE, Cochran N. How medical students can bring about curricular change. *Academic Medicine*. 1998; **73**:1173-1176.

6. Crotty M, Finucane P, Ahern M. Teaching medical students about disability and rehabilitation: methods and student feedback. *Medical Education*. 2000; **34**:659-664.

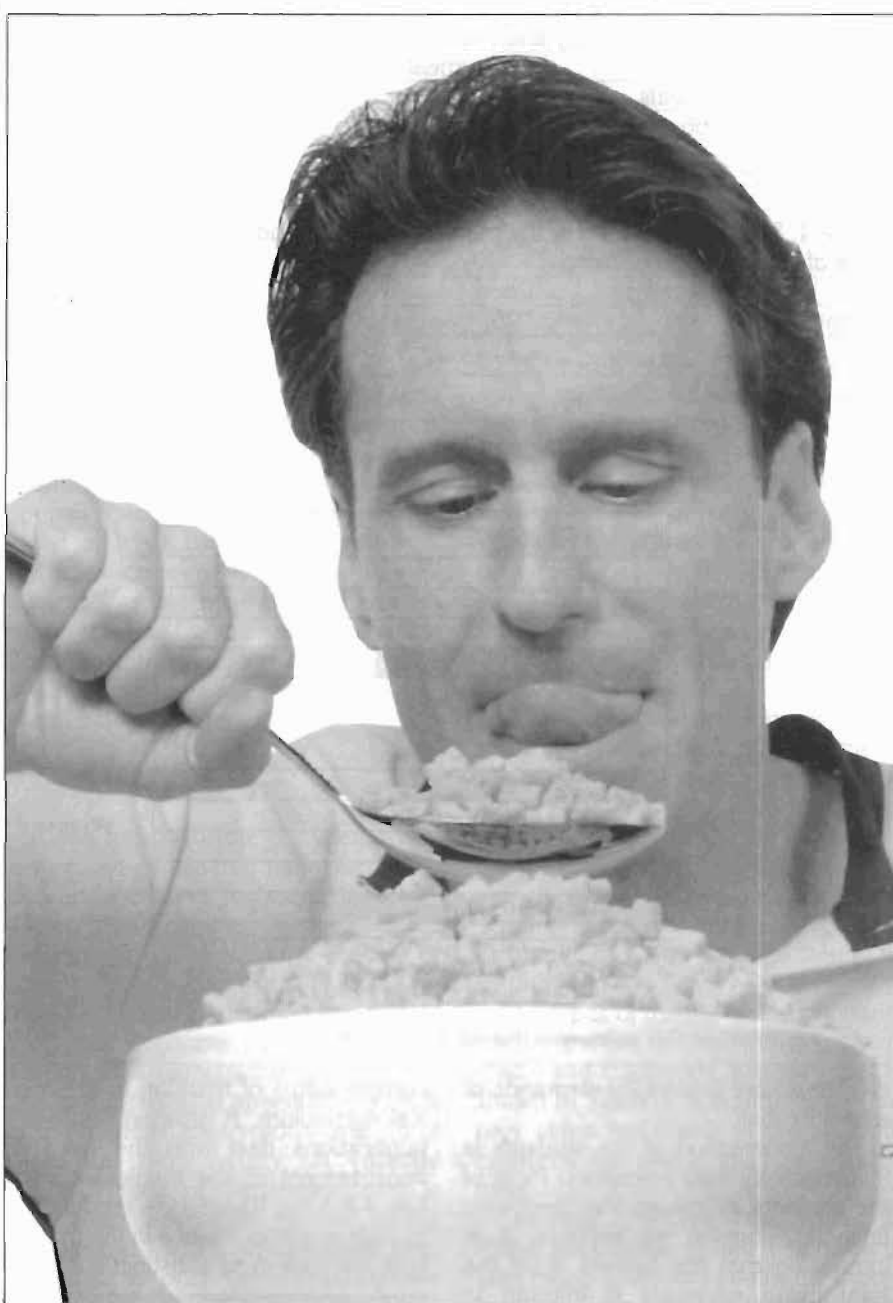
7. Guze PA. Cultivating curricular reform. *Academic Medicine*. 1995; **70**:971-973.

8. Jonas S. Health promotion in medical education. *American Journal of Health Promotion*. 1988; **3**:37-42.

9. McClary AM, Marantz P, Taylor MH. Preventive medicine 2000: changing contexts and opportunities. *Academic Medicine*. 2000; **75** Suppl:S22-27.

10. Ammerman A, McGaghie WC, Siscovick DS, Maxwell K, Cogburn WE, Simpson RJ Jr. Medical students' knowledge, attitudes, and behaviour concerning diet and heart disease. *American Journal of Preventive Medicine*. 1989; **5**:271-278.

11. Heimburger DC, Ullmann DO, Ramsey MJ, Wooldridge NH, Epps LA,



Hardin JM, Hsu C. Dietary habits of first-year medical students assessed during clinical nutrition course. *Nutrition*. 1994; **10**:214-220.

12. Hodgson CS, Wilkerson L, Go VL. Changes in nutrition knowledge among first- and second-year medical students following implementation of an integrated nutrition curriculum. *Journal of Cancer Education*. 2000; **15**:144-147.

13. Mann J. Nutrition education for medical students: the University of Otago experience. *European Journal of Clinical Nutrition*. 1999; **53** Suppl:S62-66.

14. Taren DL, Thomson CA, Koff NA, Gordon PR, Marian MJ, Bassford TL, Fulginiti JV, Ritenbaugh CK. Effect of an integrated nutrition curriculum on medical education, student clinical performance, and student perception

of medical-nutrition training. *The American Journal of Clinical Nutrition*. 2001; **73**:1107-1112.

15. Sandstrom B. A framework for food-based dietary guidelines in the European Union. *Public Health Nutr*. 2001; **4**(2A):293-305.

16. Stockley L. Toward public health nutrition strategies in the European Union to implement food based dietary guidelines and to enhance healthier life styles. *Public Health Nutr*. 2001; **4**(2A):307-324.

17. Kearney JM, Hulshof KF, Gibney MJ. Eating patterns – temporal distribution, converging and diverging foods, meals eaten inside and outside of the home – implications for developing FBDG. *Public Health Nutr*. 2001; **4**(2B):693-698.

Correspondence: Prof. Dr. L. Ángyán
E-mail: lajos.angyan@aok.pte.hu

Physical Condition of Medical Students

Orvostanhallgatók erőnléte

Tamás Téczy, András Pálfai, Zoltán Gyurkó and Lajos Ángyán

Institute of Human Movement Sciences, Medical School, University of Pécs, Pécs, Hungary

Abstract

Regular physical activity is an essential part of a healthy life style, therefore, the medical students' attitude towards a regular physical activity and sport is fundamental in developing prevention-oriented behaviour of future physicians. The purpose of the present study was to measure the physical condition of medical students. Forty-five male students were involved in this investigation. Students' activity levels were categorised into three groups: (1) recreational, doing sport activities irregularly, (2) basketball and (3) handball players, having training at least two times per week. Somatometric measures, dynamic and static motor performances, as well as resting cardiorespiratory functions were recorded. In all groups, the averages of the body mass indexes and waist-to-hip ratios were at the upper

level of the normal range, while body fat percentages were around average when compared to normal values. Better motor performances were obtained from the basketball and handball groups than from the recreational group. Averages of hand, leg and back muscles' static strengths were somewhat above the normal sedentary level. The mean values of the resting blood pressure and heart rate were in the normal range. However, six students' systolic blood pressure was above 140 mm Hg. Low blood pressure did not occur. The heart rate was elevated in three students of the recreational group. Bradycardia did not occur. The respiratory functions were at the upper level of the normal range. The present results indicate that the medical students are healthy, but their physical condition is not well trained. More physical activity is needed to improve their physical condition,

and to intensify the healthy life style of future physicians.

Key-words: leisure activities, medical education, physical fitness, sport

Összefoglaló

A rendszeres fizikai aktivitás meghatározó szerepet játszik az egészség megőrzésében; ezért a leendő orvosok egészségmegőrző gondolkodásmódjának kialakításában fontos szerepe van annak, hogy sportolnak-e, hogy végeznek-e rendszeres testedzést az orvostanhallgatók. Jelen tanulmányunkban a sportoló orvostanhallgatók erőnlétét vizsgáltuk. Összesen 45 hallgatót végeztünk méréseket. Három 15 fős csoportba soroltuk a hallgatókat: (1) vegyes csoportot alkottak azok, akik valamilyen felfrissítő testedzést végeztek alkalmanként; a 2. és 3. csoportot azok a kosárlabdázók, illetve kézilabdázók alkották, akik a Medikus Sportkörben heti két alkalommal edzettek. Szomatometriai méréseket, valamint dinamikus és sztatikus motoros próbákat végeztünk, s vizsgáltuk a cardiorespiratórikus funkciókat. Mind



három csoportban a testtömeg-index és a derék-csípő hányados a normális felső határán volt, a zsírtartalom pedig a normál tartományba esett. A motoros próbákat valamivel jobb eredménnyel hajtották végre a kosár- és kézilabdázók, mint a vegyes csoport tagjai. A kéz-, a láb- és a hátizomzat ereje nagyobb volt, mint a nem edzett egyének számára megadott értékek. Az artériás vérnyomás és a pulzusszám a normál tartományban volt. Hat esetben azonban a szisztolés vérnyomás meghaladta a 140 Hgmm-t. Alacsony vérnyomás nem fordult elő. A vegyes csoportban három hallgatónak volt magas a nyugalmi pulzusszáma. Bradycardia nem fordult elő. A légzési próbák értékei a normál tartomány felső határán voltak. Adataink azt mutatják, hogy bár a vizsgált orvostanhallgatók egészségesek, de nem tekinthetők jól edzetteknek. Erőnlétük fokozása céljából még több testedzésre lenne szükségük.

Kulcsszavak: erőnlét, orvosképzés, sport, felfrissítő testedzés

Introduction

It is well known that regular physical exercise is an important determinant of a healthy life style, and, on the contrary, physical inactivity is a serious risk factor for many diseases^{4,14}. We examined the sport activity and the physical condition of medical students. Medical students were studied because of the presumption that they were knowledgeable about exercise and would have future influence on their patients. However, learning about the benefits of exercising is not enough, then must do physical activities for their own health promotion. There is no obligatory physical education in the medical curriculum that would stimulate regular physical activity. Therefore the students can do sport activities during their leisure time. There is a sharp contrast between their knowledge about the benefits of regular physical activity and their personal exercising. A low level of physical activity was found among second-year medical students responding to a questionnaire: over 50% reported no hard physical activity¹³. According to our previous investigations there are only a few elite athletes (<3%) among the medical students. The proportion of the students who do no regular sport activities was estimated at 49% for women and 22% for men (unpublished data). Most of the students either make some recreational activities irregularly

at low level, or participate in the amateur sport-teams of the medical school, and do regular training at least two times per week. It was suggested that medical school schedules and demands appear to be the major factors that hinder student exercise⁸. Considering the great university obligations, and the students' insufficient physical activity, we examined the physical condition of the medical students in order to demonstrate that their extracurricular recreational activity is not enough for a healthy life style.

Subjects and Methods

The subjects were 45 male medical students participating in the examinations voluntarily with written consent. The Ethics Committee of the Medical School of University of Pécs permitted this study. Physical activity levels were classified into three categories: (1) recreational, (2) basketball and (3) handball players in the amateur teams. Members of the first group do sports (mainly football) irregularly, without the guidance of a physical education instructor. On the contrary, a coach trained the basketball and handball players, and they have training at least two times per week. Fifteen participants were in each group. The examination of the subjects started by recording the personal data followed by somatometry, dynamometry and measurement of cardiorespiratory functions. Thereafter the motor tests were performed in the gymnasium.

Somatometric measures and body mass index were determined. Body fat was measured with bioelectric impedance technique (OMRON BF 300). Waist-to-hip ratio was calculated.

The *motor performances* were measured by the tests based on EUROFIT.³ *Measuring hip static flexibility:* the subjects were standing on a footstool with feet together and knees straight. The task was to bend forward to reach for the maximum bending, and maintaining this position for 2 seconds. The maximum distance between the surface of the footstool (0 level) and the middle finger tip was measured, and expressed by negative numbers above the 0 level, and positive numbers below the 0 level. The result is given in cm. *The Flamingo balance test:* the subject was balancing on one leg (shoeless) on a 50 cm long, 4 cm high, and 3 cm wide wood beam. A record was made of the number of attempts needed to keep in balance on the beam for one whole minute.

Motor coordination was measured by propelling the ball at maximum speed on 14-m long distance among traffic cones 2 m apart.

The *static strength* of hand, leg and back muscular groups was measured by appropriate dynamometers (JAMAR grip tester, BACK-A). The arm and shoulder *muscular endurance* was measured by maintaining a bent arm position while hanging from a bar. The result is given in sec. The *explosive strength* was measured by a vertical jump test. First the reach height was measured when the subject was standing erect on a smooth surface and lifting up his arm. Then the vertical jump was tested. The difference in distance between the reach height and the jump height is the score. The result is given in cm.

To obtain information about the *cardiorespiratory functions*, we measured the resting arterial blood pressure, heart rate, vital capacity, duration of respiratory retention, and maximum expiratory pressure.

T-tests and analysis of variance were used for statistical analysis.

Results

The age of the participants was $20,7 \pm 0,5$ years. Members of the first group never did physical training regularly, but do some recreational activities (football, swimming, tennis, etc.) irregularly. The basketball players make sports for $8,7 \pm 1$ years and the handball players for $9,2 \pm 0,6$ years.

Somatometric Measures

As it is shown in Table 1. the averages of somatometric measures in the three groups are similar. The mean values of body mass index and the waist to hip ratio are at the upper level of the normal range, while the body fat percentages are average when compared to normal values. However, individual 29% body fat occurred in the recreational group, while the maximum value was 25% and 22% in the basketball and the handball group, respectively.

Motor Functions

Both static and dynamic motor tests were applied. The data are summarised in the Table 2. The basketball and handball players produced better results in all tests than the recreational group, but these differences are not significant statistically. Similarly, no

Table 1. The body measures (mean±SE)

| Groups | Height (cm) | Weight (kg) | Body mass index | Body fat (%) | Waist/hip ratio |
|--------------|---------------|--------------|-----------------|--------------|-----------------|
| Recreational | 182,9 ±1,7 | 78,8 ±4,2 | 23,5 ±1,0 | 14,4 ±1,6 | 0,95 ±0,01 |
| Basketball | 184,1 ±1,4 | 79,5 ±2,1 | 23,5 ±0,5 | 12,8 ±5,4 | 0,96 ±0,02 |
| Handball | 180,6 ±1,7 | 80,7 ±3,5 | 24,7 ±0,7 | 13,0 ±1,3 | 0,95 ±0,03 |

Table 2: Motor functions (mean±SE)

| Groups | Hip flexibility (cm) | Flamingo test | Hanging (sec) | Jumping up (cm) | Running (sec) | Propelling the | |
|--------------|----------------------|---------------|---------------|-----------------|---------------|----------------|------------------|
| | | | | | | handball (sec) | basketball (sec) |
| Recreational | 4 ±2 | 8,5 ±1,4 | 44,3 ±2,6 | 52 ±1,6 | 3,56 ±0,04 | 12,04 ±1,4 | 12,01 ±1,4 |
| Basketball | 6,58 ±2 | 6,6 ±3,4 | 49,8 ±3,4 | 57,8 ±1,9 | 3,38 ±0,3 | 10,35 ±1 | 10,42 ±1 |
| Handball | 9,2 ±2,2 | 6,0 ±0,8 | 55,78 ±5,4 | 58,5 ±1,75 | 3,25 ±0,2 | 10,11 ±0,65 | 10,8 ±1,6 |

Table 3: Static strengths (kg)

| Groups | Right hand | Right leg pulling | Right leg pushing | Back |
|--------------|------------|-------------------|-------------------|------------|
| Recreational | 46 ±4 | 62 ±4 | 108 ±6 | 149 ±7 |
| Basketball | 49 ±1,4 | 67 ±1,8 | 110 ±5,4 | 150 ±5 |
| Handball | 50 ±3 | 73 ±4 | 112 ±5 | 165 ±10 |

statistically significant differences were found between the averages of static strengths (Table 3).

Cardiorespiratory Functions

As it is shown in Table 4 the averages of the systolic arterial blood pressure are in the normal range. However, six students have high blood pressure (>140 mm Hg): 4 in the recreational group, and 1 in the basketball and 1 in the handball group. Low blood pressure did not occur. Also the averages of heart rate are in the normal range. Three individual heart rate values were above 80/min in the recreational group. On the other side, 60/min were obtained from 2 subjects both in the basketball and the handball groups. The respiratory measures are at the upper level of the normal range.

Discussion

The students involved in this study participate at the highest level of sport activities among the medical students. According to the principles of sports

physiology, exercising two times a week is insufficient to develop a well-trained physical condition¹⁴. But to do little recreational activities is better than to do nothing. The present data show that even this limited exercising helps to maintain physical health. All mean±SE values are average or better compared to normal sedentary levels. Considering the frequency of the training, it is not surprising that no statistically significant differences were found among the somatometric measures and cardiorespiratory data of the three groups. However, the individual values of six students are a warning. They had a body mass index above 24, greater-than-desirable body fat, wrist/hip ratio above 1, and systolic blood pressure around 150 mm Hg.

It was published that greater body mass index in young men is associated with an increased risk of subsequent knee osteoarthritis⁵. Consequently, the increase in the functional capabilities of the motor system (e.g. flexibility, power, acceleration) is better for physical condition than to increase the body mass by forcing muscular hypertrophy. Body fat is an important

component of body mass influencing various functional properties of the individual¹⁴. The percent of body fat was found to be a significant predictor of VO₂max⁹. However, besides the absolute body fat, its distribution in the body is essential. A waist-to-hip ratio 1 or higher indicates abdominal obesity, which is an important risk factor for various diseases. The waist-to-hip ratio is related to the life-style, and also secular changes have been published^{7, 10, 11}.

It is generally accepted that the resting heart rate of a well-trained person is lower than normal^{1, 6, 12, 14}. In the present study there were only four students who had heart rate of 60/min, none of the 45 students had resting bradycardia. The resting blood pressure of a well-trained person is at the lower level of the normal range. The values of our students were average or higher when compared to normal sedentary subjects.

The motor tests revealed a tendency to produce better results by basketball and handball players than the members of the recreational group did. It indicates the importance of the regular training and the guidance of the coach. The well-done training made the participants more skilful, stronger and faster than the students in the recreational group.

The above results show that the medical students involved in this study are healthy, but their physical condition is not well trained. It is

Table 4: Cardiorespiratory functions

| Groups | Systolic BP (mm Hg) | Diastolic BP (mm Hg) | Heart rate (beats/min) | Vital capacity (L) | Maximum expiratory pressure (mm Hg) | Respiratory retaining (sec) |
|--------------|---------------------|----------------------|------------------------|--------------------|-------------------------------------|-----------------------------|
| Recreational | 124±3 | 75±2 | 79±3 | 4,26±0,2 | 92±6 | 84±5 |
| Basketball | 129±2 | 77±2 | 71±3 | 4,59±0,2 | 81±6 | 69±5 |
| Handball | 125±3 | 78±2 | 75±2 | 4,97±0,2 | 82±6 | 89±7 |

shown by the somatometric data (high waist/hip ratio), and the values of the resting blood pressure and heart rate. Their physical activities are behind the optimum for health promotion. The low physical activities of medical students are often related to the vast amount of university obligations that leave little time to do sport. This view is supported by the finding that students were active in a fitness program when it was associated with an exercise physiology course involved in the curriculum².

It can be concluded from the above results that medical education should direct medical students' attitude toward exercising. It is required to increase the prestige of the well-trained physical condition among the medical students, and to motivate them to do sports as an essential component of the prevention oriented behaviour of the future physicians.

Acknowledgement: The grant NKFP 1/026, 2001 from the Hungarian Government, and a grant from the Hungarian Society of Sport Sciences supported this investigation. The authors thank Mrs. Ágnes Szabó for her technical assistance.

References

1. Aubert, A.E., Beckers, F. and Ramaekers, D.: Short-term heart rate variability in young athletes. *The American Journal of Cardiology*, 37 (1 suppl), 85-88, 2001.

2. Cohen, J.D., Drury, J. and Wright, JR: Promoting exercise and physical fitness in the medical school curriculum. *Journal of Medical Education*, 63, 438-441, 1988.

3. EUROFIT: Handbook for the EUROFIT tests of Physical Fitness. Council of Europe, Committee for the Development of Sport, Second edition, Strasbourg, pp. 42-60, 1993.

4. Fentem, P.H.: Exercise in prevention of disease. *British Medical Bulletin*, 48, 630-650, 1992.

5. Gelber, AC, Hochberg, M.C., Mead, LA, Wang, N.Y., Wigley, FM and Klag, M.J.: Body mass index in young men and the risk of subsequent knee and hip osteoarthritis. *American Journal of Medicine*, 107, 542-548, 1999.

6. Konig, D., Huonker, M., Schmid, A., Halle, M., Berg, A. and Keul, J.: Cardiovascular, metabolic, and hormonal parameters in professional tennis players. *Medicine & Science in Sports & Exercise*, 33, 654-658, 2001.



7. Lahti-Koski, M., Pietinen, P., Mannisto, S. and Vartiainen, E.: Trends in waist-to-hip ratio and its determinants in adults in Finland from 1987 to 1997. *The American Journal of Clinical Nutrition*, 72, 1436-1444, 2000.

8. Levy, BS, Goldberg, R., Rippe, J. and Love, D.: A regular physical exercise program for medical students: learning about prevention through participation. *Journal of Medical Education*, 59, 596-598, 1984.

9. Liang, MT, Dombrowski, H.T., Allen, T.W., Chang, C.O., Andriulli, J., Bastiannelli, M., Davina, E. and Norris, S.D.: Do medical students' knowledge and attitudes about health and exercise affect their physical fitness? *Journal of the American Osteopathology Association*, 93, 1020-1024, 1993.

10. Pasma, W.J., Saris, W.H., Muls, E., Vansant, G. and Westerterp-Plantenga, MS: Effect of exercise training on long-term weight maintenance in weight-reduced men. *Metabolism*, 48, 15-21, 1999.

11. Rosmond, R. and Bjorntorp, P.: Quality of life, overweight, and body fat distribution in middle-aged men. *Behavioral Medicine*, 26, 90-94, 2000.

12. Stolt, A., Kujala, JM, Karjalainen, J. and Viitasalo, M.: Electrographic findings in female endurance athletes. *Clinical Journal of Sport Medicine*, 7, 85-89, 1997.

13. Troyer, D., Ullrich, I.H., Yeater, R.A. and Hopewell, R.: Physical activity and condition, dietary habits, and serum lipids in second-year medical students. *Journal of the American College of Nutrition*, 9, 303-307, 1990.

14. Wilmore, J.H. and Costill, DL: *Physiology of Sport and Exercise*. pp. 469-530. Leeds, U.K., Human Kinetics. 1994.

Correspondence: Prof. Dr. L. Ángyán
Institute of Human Movement
Sciences, Medical School, University
of Pécs, 7624 Pécs, Jakabhegyi út 6,
Hungary

Telephone: 36-72-536-040, Fax:
36-72-536-041

E-mail: lajos.angyan@aok.pte.hu

Critical Thinking: Is it an Issue to Think about in Physical Education?

Bognár József

Semmelweis University, Faculty of Physical Education and Sport Sciences (TF), Budapest

Abstract

The article summarizes the concepts of critical thinking in the fields of general education and physical education. It is quite typical in all educational fields that the learner is in the role of a passive information receiver that permits only limited involvement in the learning process. However, learning should be viewed as a process in which students become active participants in a community of meaning makers. One of the greatest achievements in teaching critical thinking involves giving students more responsibility for their own learning. To help students become active participants in their learning process, and along with that, learn to think critically, questions play a very important role. Along this ideas and based upon the literature, the concepts of physically educated person and critical thinking are defined and the four broad areas of critical thinking are discussed.

Key-words: thinking skills, critical thinking, physically educated person, role of questions, physical education

Összefoglaló

A cikk a kritikus gondolkodás témáját öleli fel és teszi mindezt általános megközelítésből és a testnevelés szempontjából is. Sajnálatos módon minden oktatási szintre és területre jellemző, hogy a tanulók főleg passzívan fogadják be az ismereteket tanáraiktól. Mindez azt jelenti, hogy a tanulók csak mérés-kelt intenzitással vesznek részt az oktatási folyamatban, ahelyett hogy aktívabb és dinamikusabb szerepük lenne a tanulási folyamatban és ezen keresztül a tananyag értelmezésében is. A kritikus gondolkodás tanításának egyik legfontosabb eredményeként a diákok felelősséget éreznek a saját tanulásukért és szakmai előmenetelükért. Hogy a tanuló aktívan és egész személyiségével legyen részese a tanulásnak és a kritikus gondolkodásnak,

az órán feltett kérdések fontos szerepet játszanak. A cikk második felében a szakirodalom alapján megvitatásra kerülnek a testi neveléssel, a kritikus gondolkodással kapcsolatos témák testnevelés területén és a kritikus gondolkodás négy területe is.

Kulcsszavak: gondolkodási képesség, kritikus gondolkodás, testi nevelés, kérdések szerepe, testnevelés

Introduction

In this article, I plan to explore some important issues related to critical thinking in teaching and students' learning. Doing so from a physical educator's point of view, I gather recent theories and issues in the area of critical thinking and explain how they can be significant in our ever-evolving field. My role with this topic is not easy because critical thinking has not yet been examined extensively. However, most of the readers are probably familiar with critical thinking and its issues in education.

Why is the topic relevant today – one may ask. To answer this, we need to go back a little bit in time. Reading Sumner discussion from 1906, it is evident that teaching thinking and the question of thinking skills are definite-

ly not a recent phenomenon. Sumner was among the first authors to make a clear argument on the topic and pointed out that "...schools make persons all on one pattern, orthodoxy. School education, unless it is regulated by the best knowledge and good sense, will produce men and women who are all of one pattern..." (1979, p. 630). So, in the very early 20th century it was already seen that teaching models and methods focusing on only rote memorizing, remembering, and recall would not be considered as effective in any educational setting. Also, this quote refers to the assessment and evaluation methods that have been used to measure knowledge. It already seemed an important issue to promote personal and meaningful experiences, individual attention and development, choice, and interest in schools.

A little bit later, developing from similar background and concept and certainly from similar expectations of schools, Dewey (1910) listed critical thinking as a key goal of education. Unfortunately, increased attention toward critical thinking in the educational setting occurred only in the middle 1980s or so (McBride, 1995).

Some of us might believe that there is not much to think about in the physical education class and there is no need to teach thinking skills in the gym (Howarth, 2000). First and foremost



I'm writing this article to these teachers, students, and parents, hoping that when they read some of these ideas, issues, and examples from the critical thinking literature, they will think about it one more time. If I achieve this, I will be pleased. In addition to that very selfish goal of mine, the purpose of this article was to contribute to an emerging and exciting area of inquiry in the area of critical thinking that are particularly relevant to the field of physical education.

Critical Thinking Defined

I, among many others, assume that critical thinking maximizes the ability to solve problems in order to both avoid common mistakes and proceed in our thinking in the most rational and logical fashion. To be brief, critical thinking focuses on reasoning and thinking in the pursuit of truth. Why should anyone be interested in pursuing the truth? We need to mention two reasons here. First, who we are is mainly due to our ideas and beliefs. Second, our beliefs and ideas determine what we do and how we react to certain things. Now let's see what the literature has to say about critical thinking.

Lipman (1988) proposed an increased attention of teaching critical thinking as part of intellectual empowerment. As related to students' developmental stages, critical thinking is regarded as a complex process that requires knowledge and a solid foundation of understanding (Metzler, 2000). Ennis (1987) defines critical thinking as a "...reasonable and reflective thinking that is focused on deciding what to believe or do." (p.10). Other researchers characterize critical thinking as "... a matter of directing our minds along paths more likely to yield sound products of thought – sound beliefs, decisions, solutions, to problems, plans, policies, and so on" (Tishman & Perkins, 1995, p.25). In McBride's (1992) opinion, critical thinking is "...reflective thinking that is used to make reasonable and defensible decisions about movement tasks or challenges" (p.115).

I have selected three definitions here for the reader to compare and contrast. Based upon these definitions, it is obvious that critical thinking can be determined and interpreted in various ways. However, I value all of these concepts and I believe it is necessary for us to understand all of them for our later discussions. Still, McBride's definition

seems to be the closest to the area of physical education, hence let us use that concept in this paper.

Now let us see the two major components of critical thinking. First, it is a set of skills to process and generate information and beliefs. Second, it is the habit, based on intellectual commitment, of using those skills to guide behavior. The tradition of research into critical thinking reflects the common perception that human thinking is often influenced and guided by prejudice, over-generalization, common fallacies, rigidity, and narrowness. The critical thinking tradition seeks ways of understanding the mind, gathers a set of skills and then trains the intellect so that such errors and distortions of thought are minimized.

The Role of Questions

Critical thinking assumes the capacity of good reasoning that can be nurtured and developed in an educational process. The general consensus is that schooling should be meaningful for all students (Eisner, 1985, 1991, Tyler, 1986). Instruction, often necessarily prescriptive and task-oriented, may be little focused on individual development and attention. Probably these practices are quite familiar to all of us. Often a learner is in the role of a passive information receiver and seems to be locked in a passive position that permits only limited involvement in the learning process. Approaches that tend to minimize the role of the learner in his or her educational plan are not likely to provide the most meaningful experiences. Eisner (1990) encourages learning as a process in which students become active participants in a community of meaning makers. This is unlikely to occur if students are presented only with the end products of knowledge.

Perhaps it is time to ask what changes we can implement in our educational designs that will facilitate the meaningful engagement of students in their education (Blitzer, 1995). One way of looking at this problem is using questions.

The concern is not that students do not know how to think. Students need to be able to think more effectively and more critically than they typically do. To help students become active participants in their learning process, and along with that, learn to think critically, teachers should pose questions. Those questions that certainly probe student thinking and that hold students

accountable for their thinking and learning are needed. The ultimate goal is to become instilled in the thinking of students, which then guides them to better and better reasoning.

It is well known that thinking is not driven by answers but by questions. Every field keeps growing only to the extent that fresh questions are generated and taken seriously. Fresh questions are considered the driving force in a process of thinking. To think through or rethink anything, one must ask questions that stimulate thought.

Questions determine tasks, indicate problems, and portray issues. Answers on the other hand, often cause a full stop in our thinking. It is only when answers generate further questions, when thinking continues. This is why it is true that only students who have questions are really thinking and learning. Students need questions to turn on their thinking and they need to generate questions from teachers' questions. Thinking is of no use unless it goes somewhere, and again, the questions that teacher asks determine where student thinking goes.

Unfortunately, most students ask virtually none of the thought-stimulating questions. They ask dead questions like "Is this going to be on the test?" questions that imply the desire not to think and not to learn. Most teachers in turn are not themselves generators of questions and answers of their own, that is, are not seriously engaged in thinking in their own subject areas.

In most content areas thinking begins only when questions are generated by both teachers and students. No questions equal no understanding. Superficial questions equal superficial understanding. Most students typically have no questions. They not only sit in silence in the class, their minds are silent as well. If we want thinking we must stimulate it with questions that lead students to further questions.

Now critical thinking has been defined and issues in both thinking and questioning have been discussed. To make a case very quickly, I strongly believe that questioning is an important strategy in every class in an educational setting and physical education is not excepted.

Physically Educated Person

It may be easier to connect critical thinking and physical education, if we first talk about the purpose of physical education first. One could define it the following very short way: a major pur

pose of a physical education program is the development of physically educated individuals (NASPE, 1995). Most physical educators probably agree that this task extends beyond the development of children's physical skills. The practices of demonstration, drill, and play, with an emphasis on skill mastery, develop only part of our learners. It is obvious to most physical educators that cognition, affect, and social development skills, are equally important part of every educational program. Is it obvious for every teacher?

Based upon Graham, Holt/Hale, & Parker (1998), the ultimate goal or purpose of physical education is to ensure that when students graduate from high school, they are physically educated. Obviously, it implies that they participate daily or almost daily in a quality program from an early age on.

Now that we have been discussing the purpose of physical education, why don't we check out for ourselves what the characteristics of a physically educated person are by the National Association for Sport and Physical Education (NASPE, 1995):

1. Demonstrates competency in many movement forms and proficiency in a few movement forms.

2. Applies movement concepts and principles to the learning and development of motor skills.

3. Exhibits a physically active lifestyle.

4. Achieves and maintains a health-enhancing level of physical fitness.

5. Demonstrate responsible personal and social behavior in physical activity settings.

6. Demonstrates understanding and respect for differences among people in physical activity settings.

7. Understands that physical activity provides opportunities for enjoyment, challenge, self-expression, and social interaction.

Let me be clear with the following: I am not saying that this is a perfect definition of any kind. But for the article's purpose with connecting critical thinking and physical education, I believe it works just fine. Based on the NASPE list, it is obvious that it takes all cognitive, affective, and psychomotor domains into consideration when defining the physically educated person. Social aspects also play a significant part in the definition. It is clear that all of these knowledge types should be included in the definition. But how do we get to critical thinking in physical education from here?

Four Areas of Critical Thinking Performances

Critical thinking skills can be developed and enhanced in all the learning domains (Blitzer, 1995). Most critical thinking discussions and attention has mainly focused on traditional classroom settings so far. While considered an important topic, there is a little of information about critical thinking outside the core academic subject areas (McBride, 1995). The author also states that if students are to become effective thinkers at any age and any settings, then attention must be paid to all areas of the curriculum.

Physical education has always involved complex thought processes such as applying movement concepts,

defensive and offensive strategies in their classes (Howarth, 2000). So, thinking is not new for us in our physical education classes. What is the difference with critical thinking then?

In general, physical education is quite rich with opportunities to encourage students' thinking in critical ways, the challenge is learning to recognize the areas of critical thinking (Tishman and Perkins, 1995). McBride (1995) also points out that physical education setting provides great potential for critical thinking because critical thinking is used to make thoughtful decisions. Few subject areas intertwine cognitive challenges with movement-oriented activities in such an effective fashion. The affective domain is also included because students must first be predisposed toward the critical thinking process. In dispositions here I mean cooperation, willingness to take risks, open-mindedness, support and drive the critical thinking process.

Recently, scholars in physical education have begun to explore critical thinking in the psychomotor domain (Gabbard & McBride, 1990) and the issues related to teaching of critical thinking in the physical education context (McBride, Gabbard, & Miller, 1990; McBride, 1992; Schwager & Labate, 1993). Tishman and Perkins (1995) determined four broad areas of critical thinking performances. They are broad and adventurous thinking, causal and evaluative reasoning, planning and strategic thinking, and metacognition. Each of these areas needs different kinds of strategies from the students (Metzler, 2000). Based upon the work of Tishman and Perkins (1995), I give you a short summary of what these areas are and how they are used in the physical education settings.

1. Broad and adventurous thinking

Broad and adventurous thinking is seen as an aspect of creativity. It includes looking at things from different points of view and to use different ways to express certain ideas and challenge assumptions. One instance for broad and adventurous thinking could be creating an expressive movement in a folk dance routine. A question that could facilitate students' thinking in this area would be: "How can you look at this issue/movement completely differently?"

2. Causal and evaluative reasoning

Causal thinking is quite common in how people think about the physical dimension of their lives. Causal reasoning is when people examine the



causes of their health and illness, the consequences of changes in training routines. It is important when people try to indicate connections between past and present in order to understand the factors leading up to certain events. A question that could facilitate students' thinking in the area would be: "What are the hidden causes or influences of this issue?"

Evaluative reasoning involves judging an outcome of an explanation or an idea. It occurs when students judge the worth or truth of something. One instance could be if a student is a member of a karate team and somebody proposes a strategy for an upcoming match, then a student engages in evaluative reasoning by carefully considering all the pros and cons of the strategy. A question that could facilitate students' thinking in the area would be: "What are the reasons for and against this strategy?"

3. Planning and strategic thinking

Planning and developing strategies are the most common contexts of the physical education area. Preparation and goal setting for an event are examples where planning and strategizing are an important issue. Plans and strategies include numerous life activities such as planning a set of exercises or a training routine and thinking strategically how to learn a new ice-skate routine. Whatever the context, planning and strategizing are key aspects of critical thinking because they help people organize their thoughts to better achieve their goals. A question that could facilitate students' thinking in the area would be: "What obstacles can you anticipate in setting this goal?" and "How will you deal with obstacles in the process?"

4. Metacognition

The term metacognition means thinking about thinking in a self-evaluative manner. Metacognition plays the role of coach by enabling the mind to stand back from itself and reflect (or evaluate) on its own thinking processes. An example is that a tennis player reviews a lost match and sees that his/her assumptions about his opponent's poor net game were wrong. This is metacognition because the player reflects on and evaluates a belief he/she holds. Reflective thinking at appropriate moments enhances the overall integrity of physical performance because it allows the individual to be aware of his/her thinking and its connection with action and attitude, and to improve performances intelligently. A question that could facilitate

students' thinking in the area would be: "What can you learn from your thinking about similar situations in the past?"

Critical Thinking and Physical Education

Schwager and Labate (1993) suggest several ways to use critical thinking strategies in physical education settings. In critical thinking students are encouraged to apply the knowledge they receive to analyze, synthesize, compare, comprehend, and evaluate their situations. As students learn to monitor their own motor development or to apply principles related to physical activity, they become more practiced at thinking and then perhaps, habitual critical thinkers.

The affective domain presents a more significant challenge, particularly in physical education setting. Meeting instructional objectives that include cooperation, teamwork, sportsmanship, and social responsibility can be handled using a number of critical thinking strategies. Students can discuss a situation of unfair play by comparing cause and/or effects of specific events, and then predict or hypothesize about common themes, scenarios, or characters. Eventually, learners can evaluate the situation and find a way to check the credibility of their conclusions (Blitzer, 1995).

Very likely, the greatest achievement in teaching critical thinking involves giving students more responsibility for their own learning. This naturally provides a more student-centred environment in which the teacher serves as a learning facilitator. An important starting point of critical thinking is for teachers to help students become confident in identifying the problems by themselves. Sometimes identifying the problem is more difficult than deriving a solution (Woods & Book, 1995).

It is probably useful to discuss teacher-centred and student-centred instructions over here really quickly. Skilled teachers use a variety of teaching styles, depending on the needs of the students they are teaching and of course, on the specific objectives of the lesson. Besides these, factors such as teacher's personality, expertise, values, learning goals, maturity, behavior, and interest, available facilities, equipment, time, and safety considerations also influence the choice of styles (Gallahue, 1987).

Mosston and Ashworth (1994) conceptualised a series of teaching styles



that progressed from strongly teacher-centred to strongly student-centred. This conceptualization is based upon the control of decision making before, during, and after class (Metzler, 2000). Simply, we are talking about teacher-centred teaching style when the teacher retains most or all of the decisions, which results more formal and direct instruction. Physical educators tend to use this style of teaching. On the other hand, it is student-centred style of teaching when students are given more decisions to make and the instruction becomes more informal and indirect.

Teachers want to provide students with the information and skills necessary to think critically and make informed decisions both in and out of physical education class. Teachers efforts to help students become responsible for decision making in physical education should help them to become more skillful, and probably, more active for a lifetime (Woods & Book, 1995).

The Role of Evaluation

When developing thinking or critical thinking skills is a specific goal of a program, the type of assessment should reflect this emphasis. Generally, assessment and evaluation should aim at authentic tasks involving higher order thinking skills. Shick (1981) points out that a typical student's display of knowledge, the lowest level of Bloom's taxonomy, requires only remembering, recall, or recognition. Paper and pencil tests are typically designed to measure the memory retrieval performance. The upper levels of Bloom's (1956) taxonomy demand more complicated thinking skills such as comprehension, application, analysis, and evaluation. These skills are all integral parts of critical

thinking and so should be regularly assessed and evaluated for learner's success.

Increasing the levels of critical thinking in physical education does not require a total change in curriculum but a significant change in the assessment methods. Any content can be used to assist students in making well-reasoned decisions and authentically assess their performance. The critical thinking model of education requires students to think about what they are learning, and to apply, compare, and practice explaining their ideas in relation to real world and factual material to come to a deeper understanding of the new information (Paul et al., 1989).

Tactics may include large and small group activities, journals, interviews, personal bibliographies, multimedia, lab experiences, and role playing. Through continual feedback from the teacher, students are taught to recognize vagueness, ambiguity, and/or distortions in their communications (Greenockle & Purvis, 1995). When the cognitive domain is focused more systematically in the evaluation process, many students will find a new interest and inquisitiveness for physical education.

The subject matter in physical education is both critical and relevant for the holistic development and assessment of students (Blitzer, 1995). Physical educators must continuously measure their students' development and also the effectiveness of the programs they teach. Teachers must stress choices, versatility, and individuality, which require an alternative evaluation method (Stevens, 1994). Physical educators must select appropriate learning activities and authentic assessment focusing on the whole child, which coincide with children's developmental level.

Conclusions

Students must be taught to use critical thinking and to develop the dispositions of trying to be well informed, being open-minded, willing to share ideas, and being sensitive to other's ideas, which support critical thinking (Cleland & Pearse, 1995). Buschner (1990) stated that "...in physical education, thinking, feeling, and moving are co-equal partners" (p. 59).

According to our purpose in education, we must expand our appreciation for moral integrity, ethics, and social responsibility on all educational levels. Helping students develop a capacity

for thinking critically may be appropriate and successful way to this achievement (Blitzer, 1995). Since the emphasis is on the whole child, development of the whole individual can be achieved if children are encouraged to respond to challenges through movement, as well as verbal responses (Stevens, 1994).

The time for critical thinking in physical education has most definitely arrived. The topic is a complex and has many aspects and will certainly challenge teachers to think about how physical education should be taught (McBride, 1995).

References

- Blitzer, L. (1995). "It's a gym class... What's there to think about?" *Journal of Physical Education, Recreation, and Dance*, 66(6), 44-48.
- Bloom, B. (Ed.). (1956). *Taxonomy of educational objectives* (p. 62). Longmans, New York.
- Buschner, C.A. (1990). Can we help children move and think critically? In W.J. Stinson (Ed.), *Moving and learning for the young child* (pp. 51-66).
- Cleland, F. & Pearse, C. (1995). Critical thinking in elementary physical education: Reflections on a yearlong study. *Journal of Physical Education, Recreation, and Dance*, 66(6), 31-38.
- Dewey, J. (1910). *How we think*. D.C. Heath, Boston.
- Eisner, E. (1985). *The educational imagination*. Macmillan, New York.
- Eisner, E. (1990). Creative curriculum development and practice. *Journal of Curriculum and Supervision*, 6(1), 62-73.
- Eisner, E. (1991). *The enlightened eye*. Macmillan, New York.
- Ennis, R. (1987). A taxonomy of critical thinking dispositions and abilities. In J. Baron & Sternberg (Eds.), *Teaching thinking skills: theory and practice* (pp.9-26). W.H. Freeman, New York.
- Gabbard, C. & McBride, R. (1990). Critical thinking in the psychomotor domain. *Journal of the International Council on Health, Physical Education, and Recreation*, 26(2), 24-27.
- Graham, G., Holt/Hale, S.A., & Parker, M. (1998). *Children moving: A reflective approach to teaching physical education* (4th edition). Mayfield Publishing Company, Mountain View, CA.
- Greenockle, K.M. & Purvis, G.J. (1995). Redesigning a secondary school wellness unit using the critical thinking model. *Journal of Physical Education, Recreation, and Dance*, 66(6), 49-52.
- Howarth, Kath (2000). Context as a factor in teachers' perceptions of the teaching of thinking skills in physical education. *Journal of Teaching in Physical Education*, 19, 270-286.
- Lipman, M. (1988). Critical thinking - What can it be? *Educational Leadership*, 46(1), 38-43.
- McBride, R. E. (1992). *Critical thinking: An overview with implications for physical education*. *Journal of Teaching in Physical Education*, 11, 112-125.
- McBride, R.E. (1995). ...An idea whose time has come! *Journal of Physical Education, Recreation, and Dance*, 66(6), 22-23.
- McBride, R.E., Gabbard, C., & Miller, G. (1990). Teaching critical thinking skills in the psychomotor domain. *The Clearing House*, 63, 197-201.
- Metzler, M.W. (2000). *Instructional models for physical education*. Allyn and Bacon, Boston.
- Mosston, M., & Ashworth, S. (1994). *Teaching physical education*. (4th ed.). Macmillan, New York.
- National Association for Sport and Physical Education (1995). *Moving into the Future: National Standards for Physical Education*. Mosby, St. Louis.
- Paul, R., Binker, A.J.A., Martin, D., & Adamson, K. (1989). *Critical thinking handbook: Highschool*. Rohnert Park, CA: The Center for Critical Thinking and Moral Critique, Sonoma State University.
- Schwager, S., & Labate, C. (1993). Teaching for critical thinking in physical education. *Journal of Physical Education, Recreation, and Dance*, 64(5), 24-26.
- Shick, J. (1981). Written test in activity classes. *Journal of Physical Education and Recreation*, 52(4), 21, 22, 83.
- Stevens, D.A. (1994). Movement concepts: Stimulating cognitive development in elementary students. *Journal of Physical Education, Recreation, and Dance*, 66(7), 16-23.
- Sumner, W.G. (1979). *Folkways*. Ayer Co. Publishing, Salem, NH.
- Tishman, S., and Perkins, D. (1995). Critical thinking and physical education. *Journal of Physical Education, Recreation, and Dance*, 66(6), 24-30.
- Tyler, L.L. (1986). Meaning and schooling. *Theory into Practice*, 25(1), 53-57.
- Woods, A.M. & Book, C. (1995). Critical thinking in middle school physical education. *Journal of Physical Education, Recreation, and Dance*, 66(6), 39-43.

Physique, Body Composition and Motor Performances in College Students

Testalkat, testösszetétel és motoros teljesítmények főiskolai hallgatóknál

Szakály Zsolt

West-Hungarian University, Apáczai Teacher Training College, Győr

Summary

The transition in Hungarian society with its negative characteristics appears to a considerable extent in higher education. One of these is immobile lifestyle. The examination targeted the following: 1. The examination of habitude based on a questionnaire, which made it possible to obtain data of student's life-style and social status. 2. The definition of students' build and body composition. 3. Definition of the examined group's motor performance features by means of four motor-tests. The subjects of the study are in their first year at the West-Hungarian (University Apáczai Teacher Training College (male, n=25, female, n= 105) in the socialworker, cultural affairs organizer and elementary school teacher departments, having 2 PE periods a week. The other group receives special training and will become elementary school PE teachers (female, n = 23, male, n = 13). For the questionnaire we used the Győr-Moson-Sopron County ÁNTSZ Health Protection Department's „Habitude survey of the Adult Population” method.(Bajtay 1999). Physique-build was examined Heath and Carter (1967), Conrad (1963) and body composition with guidelines from Drinkwater and Ross (1980). The motor performances were measured by Cooper-test, 30 m run, standing longjump, Indian club-slam. The data of the habitude survey shows that PE-department students spend more of their free-time taking some form of physical exercise, than the other group. However their motor abilities are the same. Significant differences can only be seen in the dynamic performance and manual skills of female students. The male PE students have better motor performances which is

due to lower body fat figures and higher muscle-ratio and the fact that on every motor test their co-ordination played a major role. In the case of females we find that there is a striking difference between the estimated muscle and fat, though even the PE student's fat percentages are higher than it would be expected for their age group. Body composition differences appear in motor-test results as well. A large fat content in body composition is paired with small muscle mass, aerob- and dynamic power performances, its disadvantageous effect can be clearly seen among females in the traditional group. Based on our examination, we can conclude that in the students we found risk factors which lead to cardio-respiratory system disorder and obesity in later life.

Key-words: lifestyle, physique, body composition, motor performances

Összefoglalás

A magyar társadalom átalakulásának szinte minden negatív jellemzőjének kisebb-nagyobb mértékben megjelenik a felsőoktatásban. Ezek egyike a mozgásszegény életmód. A vizsgálat során a következő célokat tűztük ki: 1. Életmód vizsgálat kérdőív felhasználásával. 2. A főiskolások testalkatának, testösszetételének meghatározása. 3. A vizsgált személyek motoros teljesítmény-jellemzőinek meghatározása. A vizsgált személyek elsőéves férfi és női tanítóképző főiskolai hallgatók, akik, szociálpedagógus, művelődésszervező, tanítói szakokon (nők, n=105, férfiak, n=25) tanulnak, illetve testnevelés műveltségterületen (nők, n=23, férfiak, n=13) tanuló hallgatók. Az életmód vizsgálat során a Győr-Moson-Sopron Megyei ÁNTSZ Egészségvédelmi Osztályának a „Felnőtt lakosság körében végzett életmódkutatás” kérdőívvel fel-

mérési módszerét alkalmaztuk. A testalkatot Heath és Carter (1967), valamint Conrad (1963), a testösszetételt Drinkwater és Ross (1980) eljárási javaslatait követve vizsgáltuk. A motoros próbák a következők voltak: Cooper-teszt, 30 m-es síkfutás, helyből távolugrás, buzogány-szlam. Az életmód vizsgálat adatai szerint a testnevelés szakos hallgatók szabadidejükben többet mozognak, mint a másik csoport, azonban a motoros képességek átlagai megegyeznek. Szignifikáns különbséget csak a nők dinamikus erejét és kezűgyességét mérő próbák esetében tapasztaltunk. A testnevelés szakos férfiak jobb motoros teljesítményeinek a háttérben a kisebb testsírszázalék, a nagyobb izomarány és a minden motoros próbában szerepet játszó koordinációs gyakorlottsági szint állhat. A nők esetében markáns különbség tapasztalható a becsült izom és zsír tekintetében, bár a testnevelés szakosok zsírszázaléka is nagyobb, mint az életkor alapján az elvárható lenne. A testösszetétel különbözősége megjelenik a motoros próbákban elért eredményekben is. A nagy testsírszázalék és a hozzá párosuló kicsi izomarány aerob- és dinamikus erőteljesítményt befolyásoló kedvezőtlen hatása jól megfigyelhető a nem testnevelés szakos nők gyengébb fizikai teljesítményeiben. A vizsgálat eredményei alapján levonható az a következtetés, hogy hallgatóinknál mind a kardio-respiratorikus rendszer, mind az elhízás rizikófaktorai megtalálhatóak, melyek előrevetítik az egészségi állapot kedvezőtlen változásait.

Kulcsszavak: életmód, testalkat, testösszetétel, motoros teljesítmények

Introduction

The transition in Hungarian society with its negative characteristics appears to a considerable extent in higher education. One of these is immobile lifestyle. (Kertai 1994). According to

the survey over 40 % of students did not participate in any sports in their free time, the only source of activity was insitutional PE, once or twice a week. Together with an unhealthy diet, the disorder in the optimal balance of food/ recreation, this may have serious consequences (Sebőkné 1999).

In Hungary, the figures for disease and mortality are gradually worsening, among which the cardio- respiratory system disorders are significant (Szabó and Frenkl 1996, Fehérné 1999.) In connection to this, obesity is another reason for anxiety, which occurs when the consumption of food and the amount of energy used for work do not balance. Obesity is a disorder in which body composition changes and which produces a tendency towards other diseases (Kovácsné 1997, Farrell et al. 1998, Blair- Brodney 1999, Wei et al. 1999).

This paper shows the first results of longitudinal section examination.

The examination targeted the following:

1. The examination of habitude based on a questionnaire, which made it possible to gain data of students life-style and social status.
2. The definition of students' build and body composition.
3. Definition of the examined group's motor performance features by means of four motor- tests.

Material and methods

The subject of the study are in their first year at the West- Hungarian University Apáczai Teacher Training College (male, n=25, female, n= 105) in the socialworker, cultural affairs organizer and elementary school-teacher departments, having 2 PE periods a week. The other group receives special training and will become elementary school PE teachers (female, n = 23, male, n = 13). We have the written permission of all students into the study.

For the questionnaire we used the Győr- Moson- Sopron County ÁNTSZ Health Protection Department's „Habitue survey of the Adult Population” method.(Bajtay 1999).

Physique- build was examined Heath and Carter (1967), Conrad (1963) and body composition with guidelines from Drinkwater and Ross (1980).

The **Heath and Carter** physique typology aimed to define the examined individual's phenotype. According to this method, build can be characterized by three components. I. component (rela-

tive obesity) is defined by measuring the triceps-, scapula and hip fold on the right side of the body. The total of the three gives the first components relative weight. II. component (relative robusticity) to define, we must know the thickness of skinfold on the medial side of the lower leg and triceps, the measurement of the thigh, the bent and stretched upper arm, the width of the condylus, the femur and the humerus, furthermore the definition of height. III. component (relative slenderness). The so- called Hirata ratio index must be calculated. $\text{Index} = \text{height} * (\text{build})^{-0.33}$. As Heath- Carter suggests, the human build can be defined by 3 components (buildcomponents) as the relative balance of the momentary morfotype. The method concludes that the individual's build can be given in three figures.

Conrad's method assumes knowledge of body dimensions. Build is defined along two lines of development. The various types are summarised in the index gained from body measurements. Alternative versions in build can be derived from the metric index (MIX) and the plasticity index (PLX) which shows how mobility development aligns to build, in a right angle system of co- ordinates, the chest diameter (width, depth) corrected by the linear function of the height, which seems to characterize the pycnic or leptosome features of the vertical axis of the co-ordinate system. PLX: bone structure and muscle characteristics in three figures (shoulder width, diameter of lower arm and circumference of the hand) as an arithmetic total, which gives the horizontal axis.

In the past 15 years, the **Drinkwater and Ross** method, based on estimation has become commonly know in antropometry. The method assumes that if we define certain data of body composition, the fractions should be equal to the easily obtainable body weight. According to this method the human body can be divided into the following fractions: mass of striated muscle, bone mass, essential and stored fat and the rest, the so-called residual mass which is mainly composed of intestines. To define the body composition of students we used the value of muscle percentage as compared to total weight. To show the fat content of the body we used the **Parizková** (1961) method.

For measurements we used calibrated instruments. Concluding an F- test, the measured figures were processed

with a two- sample T- test with a 5% level of random error. The aerobe endurance was measured by the Cooper-test. The test establishes the oxygen uptake ($\text{VO}_2 \text{ max.}$) with a spiroergometric examination during running which is compared to a $r = 0,9$ correlation factor (Cooper 1970). According to other methods of examination, the connection is not so tight. In case of females Bovend'eerdt et al. (1980) 0,65 and males 0,58 correlation values are defined. Kemper (1982) defined similar values using an even larger sample. With a 30 m run with standing dab start we examined the students accelerations. Field of use: to examine acceleration ability (Fetz- Kornexl 1978). Long jump from standing dab to examine the dynamic strength of the lower limb and co-ordination of arm- torso- leg (Fetz- Kornexl 1978.). Indian club- slalom test to measure manual skill and total body co- ordination under stress of time element (Hirtz 1976).

Results

Certain characteristics of the habitude of students. The tables show the characteristics of student's habitude and the measured antropometric figures, motor ability in group averages and spread. The first table contains data on the students habitude. The students in the Physical Education Department, both male and female, spent more time at college, than the other group. We can assume that the extra time spent at college would mean afternoon sports activity. The males in the PE. Department group said, that in spite of extra time at school, they had more free- time than the other group. In the case of females, the amount of free-time is the same in both groups. When examining time spent sleeping or on the various media, there is no significant difference between the groups. The PE group reported more time spent with physical exercise than the traditional department- group. Females from the non PE. group get the least exercise. Clubbing and eating out represent similar timefactors in both groups.

Table 2. shows the antropometric features of males. According to a certain method of defining optimal body mass (Fehérné 1999), the fat content of the body compared to body mass is normal. In the group averages we found certain differences in the estimated body fat, the estimated muscle mass, in the plastical index and the Heath -carter I. component, although

Table 1. Features of students lifestyle

| | Men | | Women | |
|--------|--|-----------------------------------|--------------|-----------------------------------|
| | Average timespent at college (hour/week) | | | |
| | PE. students | Cultural organiser, Social worker | PE. students | Cultural organiser, Social worker |
| n | 13 | 25 | 23 | 105 |
| Mean | 31 | 26 | 30 | 27 |
| Median | 30 | 26,5 | 30,5 | 25 |
| Range | 25- 40 | 15- 40 | 23- 40 | 20- 35 |
| | Free- time (hour/week) | | | |
| Mean | 34 | 28 | 26 | 28 |
| Median | 31,5 | 26,5 | 25,5 | 30 |
| Range | 10- 60 | 5- 60 | 15- 50 | 15- 50 |
| | Sleep (hour/day) | | | |
| Mean | 8 | 8 | 8 | 8 |
| Median | 8 | 8 | 8 | 8 |
| Range | 5,5- 9 | 6- 12 | 7- 9 | 6- 10 |
| | Medias (TV, radio, reading)(hour/day) | | | |
| Mean | 3 | 3 | 3 | 3 |
| Median | 3 | 3 | 2,8 | 2 |
| Range | 0,5- 4 | 1- 6,5 | 1- 5 | 0- 7 |
| | Exercise winter (hour/week) | | | |
| Mean | 5 | 4 | 6 | 4 |
| Median | 4 | 3 | 5,8 | 4 |
| Range | 2- 10 | 0- 10 | 2-15 | 0- 8 |
| | Exercise summer (hour/week) | | | |
| Mean | 8 | 4 | 7 | 4 |
| Median | 6 | 6,5 | 7,3 | 6 |
| Range | 2- 22 | 0- 10 | 2-15 | 0- 8 |
| | Clubbing, eating out (hour/week) | | | |
| Mean | 5 | 5 | 4 | 4 |
| Median | 4 | 3 | | 4,5 |
| Range | 2- 15 | 0- 20 | 0- 9 | 0- 10 |

Signs and abbreviations used: n = number of elements, Range = largest and lowest measured value

Table 2. Antropometric features in male

| | PE. (n: 13) | | | Traditional group (n: 25) | | | p | |
|------------------------|-------------|-------|-------------|---------------------------|-------|--------------|-------------|----|
| | x | sd | range | x | sd | range | | |
| Age | 20,45 | 1, 51 | 18,54-23,3 | 20,26 | 1,46 | 18,38- 24,67 | NS | |
| Height (cm) | 176,20 | 6,64 | 166,3-188,0 | 177,70 | 7,84 | 164,5- 192,0 | NS | |
| Weight (kg) | 69,61 | 7,72 | 54,5- 84,00 | 70,90 | 11,34 | 54,7- 104,30 | NS | |
| Body fat% (Parizková) | 15,22 | 3,81 | 9,33- 22,66 | 18,63 | 5,25 | 7,91- 29,71 | NS | |
| Estimated muscle % | 43,94 | 2,39 | 39,77-47,04 | 40,75 | 3,00 | 33,39- 45,91 | NS | |
| Conrad component | MIX | -0,74 | 0,40 | -1,49, -0,07 | -0,95 | 0,46 | -1,97- 0,39 | NS |
| | PLX | 90,21 | 3,09 | 82,5- 95,20 | 88,44 | 4,82 | 74,1- 96,50 | NS |
| Heath-Carter component | I. | 3,39 | 1,04 | 1,84- 5,52 | 4,39 | 1,64 | 1,84- 8,51 | NS |
| | II. | 4,35 | 1,36 | 2,30- 7,15 | 4,41 | 1,20 | 1,78- 6,66 | NS |
| | III. | 2,83 | 1,06 | 1,10- 4,73 | 2,96 | 1,28 | 0,53- 6,61 | NS |

Signs and abbreviations used: n = number of elements, x=average, sd=standard deviation, Range = largest and lowest measured value, NS= not significant

these are not significant. The larger muscle mass and lower body fat found in PE. students shows that regular exercise has a beneficial effect on body composition.

According to the Heath- Carter somatotypical method the PE group males can be ranked to a central category. The students in traditional departments can be found in endo- mezo- ectomorf spheres. This group's height averages as in component I. have a possibility of change in body composition towards a negative value.

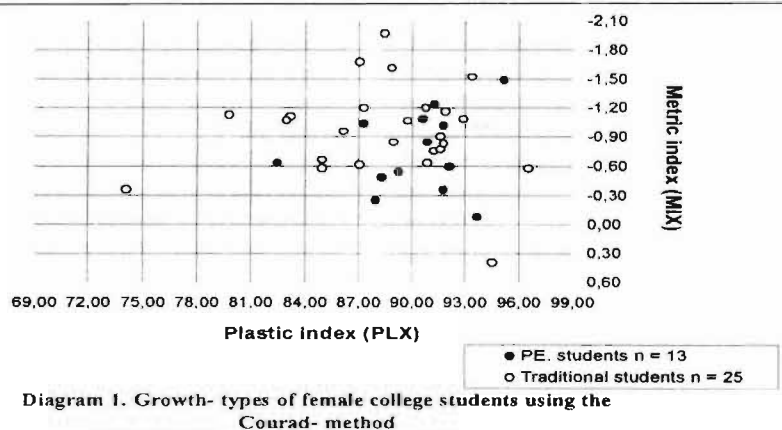


Table 3. Antropometric features in Women

| | PE. students (n: 23) | | | Traditional group (n: 105) | | | p | |
|------------------------|----------------------|-------|--------------|----------------------------|-------|--------------|--------------|--------|
| | x | sd | range | x | sd | range | | |
| Age | 19,97 | 0,93 | 18,79- 22,55 | 19,70 | 1,27 | 18,20- 24,70 | NS | |
| Height (cm) | 165,1 | 5,35 | 150,60-174,4 | 165,80 | 5,49 | 154,00-177,2 | NS | |
| Weight (kg) | 58,70 | 10,05 | 46,00-95,00 | 57,60 | 9,12 | 40,90- 87,0 | NS | |
| Body fat % (Parizková) | 24,29 | 4,97 | 14,06- 34,96 | 27,89 | 6,36 | 14,06- 44,20 | NS | |
| Estimated muscle % | 39,21 | 2,44 | 33,67- 43,15 | 33,58 | 3,9 | 23,04- 42,97 | p<0,001 | |
| Conrad component | MIX | -0,77 | 0,48 | -1,49- 0,40 | -1,28 | 0,52 | -2,27- 0,87 | p<0,05 |
| | PLX | 80,74 | 3,88 | 73,70- 87,40 | 77,70 | 3,9 | 68,20- 90,00 | NS |
| Heath-Carter component | I. | 4,79 | 1,31 | 2,60- 8,51 | 5,40 | 1,68 | 2,23- 9,76 | NS |
| | II. | 3,48 | 1,27 | 1,56- 6,63 | 3,47 | 1,5 | 0,50- 10,00 | NS |
| | III. | 2,71 | 1,02 | 0,50- 4,63 | 3,04 | 1,31 | 0,50- 7,21 | NS |

Signs and abbreviations used: n = number of elements, x=average, sd=standard deviation, Range = largest and lowest measured value, NS= not significant

Table 4. Motor performances of men

| | PE. students (n: 13) | Traditional students (n: 25) | p |
|--------------------------|----------------------|------------------------------|----|
| Cooper- test | | | |
| Mean | 2725,38 | 2514,8 | NS |
| SD | 356,92 | 409,77 | |
| Range | 2280- 3580 | 1550- 3420 | |
| 30- metre sprint | | | |
| Mean | 4,65 | 4,8 | NS |
| SD | 0,25 | 0,34 | |
| Range | 4,2- 5 | 4,3- 5,6 | |
| Static jump | | | |
| Mean | 232,3 | 221,56 | NS |
| SD | 14,02 | 20,56 | |
| Range | 210- 266 | 183- 260 | |
| Club- slalom test | | | |
| Mean | 4,28 | 5,04 | NS |
| SD | 0,46 | 0,72 | |
| Range | 3,4- 4,8 | 4,1- 7,2 | |

Signs and abbreviations used: n = number of elements, x=average, sd=standard deviation, Range = largest and lowest measured value, NS= not significant

In figure one we see male student's physical build with the Conrad method. In both groups examined the picnomorf characteristics are dominant, although in PE group, the endomorf is not ambiguous and we find metromorf features. One interesting finding is that the picnomorf build, which genetically could lead to obesity, is found together

with hyperplasticity in bone and muscle structure. We must note the large spread shows a relevant diversity in the build of the examined individuals, which can be well seen in the Conrad component.

Table 3 shows the body composition figures and build of the women. The averages are mathematically the

same, body fat strays from the average but not in significant differences. According to the system of verifying optimal body mass, the students are all in the normal region (Fehérné 1999). Both groups show surprising body fat percentages, which is high for this age-group and the traditional group have low muscle percentages, which means an adverse body composition.

According to the Heath- Carter typisation the PE students are mezo- endomorf, the traditional group are a balanced endomorf type. In female students the high body fat and relatively small muscle mass are a good example of the endomorf build so characteristic to unfavourable body composition.

In diagram 2 we can see the characteristics in physical build in the Conrad-method. According to this, the picnomorf features are dominant in the PE group together with a normoplastic bone and muscle structure. The traditional group has a build which is metromorf along with normoplastic bone- muscle structure. The figures show a smaller degree of spread than in males. However it is possible to find extremes here as well.

Motor performances

In tables 4. and 5. we show the group averages and spread of the motor performance tests of students. The men show a statistically equivalent figure. The Cooper- test averages are very close to the reference figures of Barabás (1988) and those of Fehérné (1999) in a similar sample. Cooper (1970) defines the PE students values as „excellent”, while the other group receives a „good” rating.

The 30 meter sprint averages do not reach the Grosser and Starischka (1981) values for „average” physical fitness in males. In this case, we see that the values of 20 years ago show

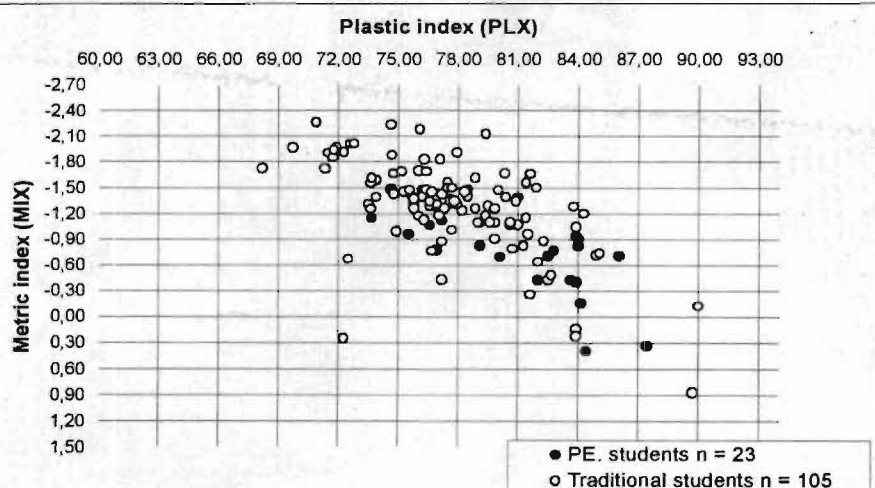


Diagram 2. Growth- types of female college students using the Conrad- method

that today we have worse figures. Tests to measure the dynamic power of the lower limbs by rating static jump performances reach those preferable for this age- group (Fehérné 1999). The club- slalom test showed better figure for PE students and smaller spread.

Cardio-respiratory results in females show satisfactory levels in PE students while in the other group these do not reach the age- group standard (Barabás 1978, Fehérné 1999). Cooper (1987) show PE students as well exercised while the traditional group are in the „poor” category.

The 30 meter sprint averages do not reach the Grosser and Starischka (1981) „average- fitness” levels for women. The static jump and skill- test averages statistically vary.

Discussion and Conclusion

The data of habitude survey shows that PE- department students spend more of their free- time taking some form of physical exercise, than the other group. However their motor abilities are the same. Significant differences can only be seen in the dynamic performance and manual skills of female students. We should focus on the figures of males as to physical build and body composition, where the

Table 5. Motor performances of women

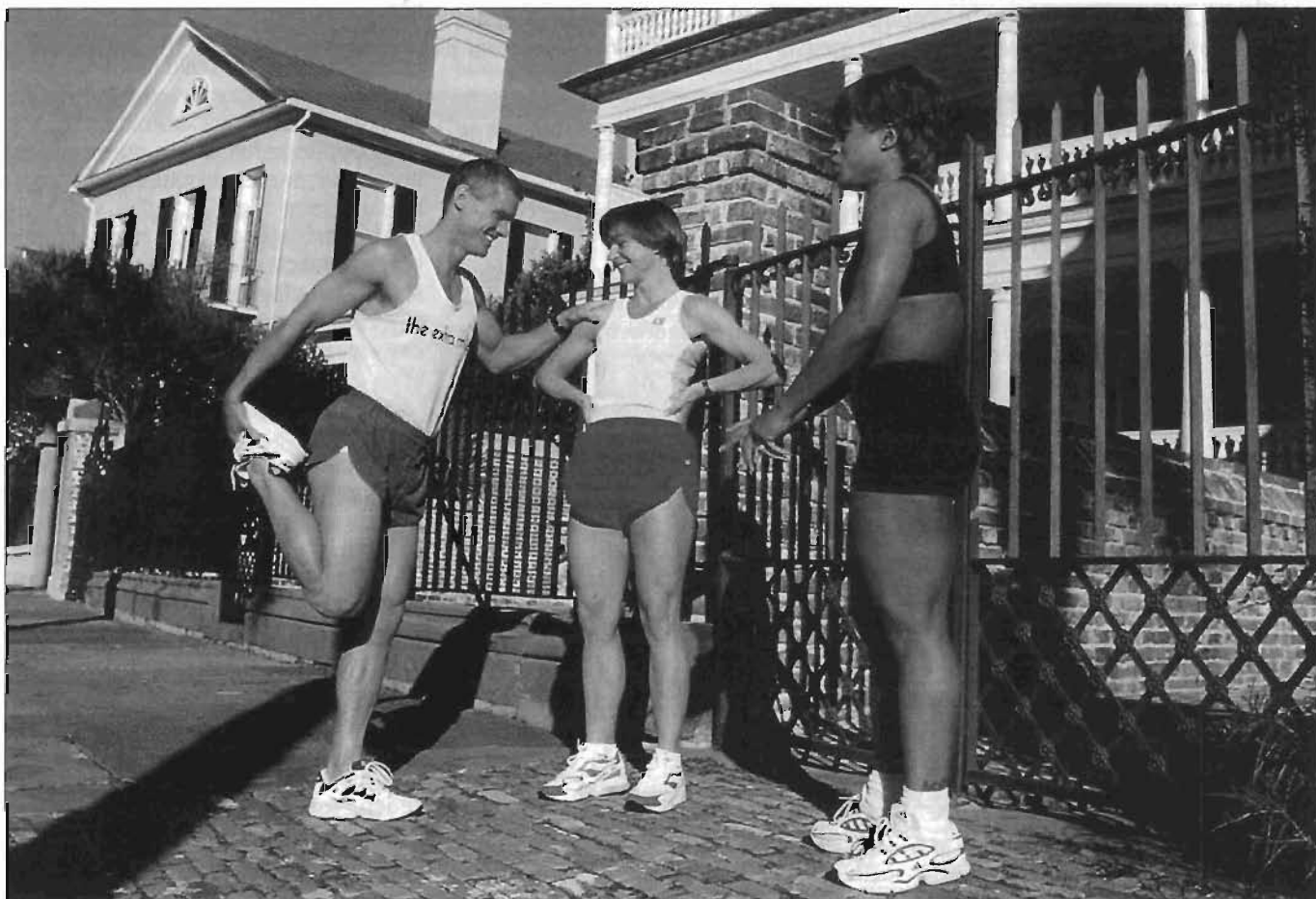
| | PE. students (n: 23) | Traditional students (n: 105) | p |
|--------------------------|----------------------|-------------------------------|-------|
| Cooper- test | | | |
| Mean | 2193,04 | 1778,3 | NS |
| SD | 257,87 | 208,07 | |
| Range | 1880- 3420 | 1130- 2410 | |
| 30- metre sprint | | | |
| Mean | 5,39 | 5,74 | NS |
| SD | 0,35 | 0,45 | |
| Range | 4,7- 6 | 4,9- 7,2 | |
| Static jump | | | |
| Mean | 187,95 | 160,88 | p< |
| SD | 11,95 | 18,58 | 0,001 |
| Range | 160- 220 | 120- 210 | |
| Club- slalom test | | | |
| Mean | 4,93 | 5,8 | p< |
| SD | 0,43 | 0,65 | 0,001 |
| Range | 3,8- 5,6 | 4- 7,5 | |

Signs and abbreviations used: n = number of elements, x=average, sd=standard deviation, Range = largest and lowest measured value, NS= not significant

averages are statistically equal. The male PE students have better motor performances which is due to lower body fat figures and higher muscle-ratio and the fact that on every motor test their co- ordination played a major role. In the case of females we find that there is a striking difference between the estimated muscle and fat, though even the PE student's fat percentages are higher than it would be expected of their age group. Body composition differences appear in motor- test results

as well. A large fat content in body composition is paired with small muscle mass, aerob- and dynamic power performances, its disadvantageous effect can be clearly seen among females in the traditional group.

Based on our examination, we can conclude that in the students we found risk factors which lead to cardio- respiratory system disorder and obesity in later life. The problem is further aggravated by the fact that in the case of these students, who will work as teach-



ers, social workers or cultural affairs organizers, it is their concern to work in the field of health protection and project a healthy lifestyle.

The antropometric figures and numbers in the survey prove that we have a large spread between male and female students, which projects that the build, body composition and physical performance of students is in sharp contrast. This is another fact which calls for the necessity of Physical Education and the different levels of ability in higher education.

The results of the survey have enabled us to give students a picture of their physical abilities and present status, thus motivating them to lead healthier lives and to participate in regular exercise and actively respond to Physical education.

References

Bajtay A. (szerk.)(1999): Győr- Moson- Sopron megye egészségtérképe 1991-1996. ÁNTSZ Győr-Moson- Sopron megyei Intézete.

Barabás A. (1988): A futó- erőállóképesség hazai referencia értékei. *Testnevelés és Sporttudomány*. 168-175.

Blair, SN.- Brodney, S.(1999): Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues. *Med. Sci. Sports. Exerc.* nov. 31(11suppl) 646.

Bovend'eerd, J.- Kemper, H.G.- Verschuur, R. (1980): De MOPER fitness test. Handleidingen prestatieschalen. De Vrieseborc. Haarlem.

Conrad, K. (1963): *Der Konstituententypus*. 2. Auflage. Springer. Berlin.

Cooper, K. H.(1970): *The new aerobics*. M. Evans and Co. Inc. New York.

de Oliveira, CL.- da Veiga, GV.- Sichiari, R.(2001): Anthropometric markers for cardiovascular disease risk factors among overweight adolescents. *Nutrition Research* 21 (10): 1335-1345

Drinkwater, D.T.- Ross, W.D. (1980): Anthropometric fractionation of body mass. In: Ostin, M. Beunen, G. and Simons, J. (Eds.): *Kinanthropometry II*. University Park Press, Baltimore.

Farrell, SW.- Kampert, JB.- Kohl, HW.- Barlow, CE.- Macera, CA.- Paffenbarger, RS. Jr.-Gibbons, LW.- Blair, SN.(1998): Influences of cardiorespiratory fitness levels and other predictors on cardiovascular disease mortality in men. *Med. Sci. Sports Exerc.* 30(6):899-905.

Fehérné M.I.(1999): Se többet, se kevesebbet. Útmutató. Széchenyi Nyomda. Győr.7-13.



Fetz, F.- Kornexl, E.(1978): *Sportmotorische Test*. Bad Homburg.

Grosser, M.- Starischka, S. (1981): *Konditionstest. Theorie und Praxis aller Sportarten*. BLV Verlagsgesellschaft GmbH. München.

Heath, B. H.- Carter, J. E. L.(1967): A modified somatotype method. *Amer. J. Phys. Anthropol.* 1. 57-74.

Hirtz, P.- Ludwig, G.(1976): Ziele, Mittel und Methoden der koordinativ-motorischen Vervollkommung der Schulkinder im Sportunterricht. *Körperziehung*. 11. 506-510.

Kamper, HCG.(1982): The 12 and 6 minute endurance run as a field test for cardiorespiratory fitness of schoolchildren. 4.th Eur. Res Seminar on Testing Physical Fitness. Strassbourg. *CDDS* (82) 61. 69-77.

Kertai P. (1994): A magyar nép-egészségügy prioritásai az ezredfordulóg. Győr- Moson- Sopron megye Egészségvédelmi terve. Állami Népegészségügyi és Tisztiorvosi Szolgálat Győr- Moson- Sopron megyei Intézete. Győr. 13.

Kovácsné T. E. (1997): Elhízott gyerekek és a testmozgás. Hogyan tovább? Győr- Moson- Sopron megyei pedagógusok folyóirata. 4- 6.

Parizková, J.(1961): Total body fat and skinfold thickness in children. *Matabolizm*. 10:797-804.

Sebőkné L.M.A.(1999): A szakmódszertan szerepe és társadalmi változásai a testnevelés oktatásában a tanítóképzésben. In: Kovácsné N. M. (szerk.). *Nyugat- Magyarországi Egyetem Apáczai Csere János Tanítóképző Főiskolai Kar Évkönyve*. Győr.119- 126.

Szabó T.- Frenkl R. (1996): Testösszetétel, fittség. In: Som F. (szerk.): *Felsőoktatás, értelmiség, egészség*. MEFS. Budapest. 17-50.

Wei, M.- Kampert, JB.- Barlow, CE.- Nichaman, MZ.- Gibbons, LW.- Paffenbarger, RS. Jr.-Blair, SN.- Brodney S. (1999): Relationship between low cardiorespiratory fitness and mortality in normal-weight, overweight, and obese men. *Jama*. 282(16):1547-1553.p.

Szakály Zsolt: szakalycs@axelero.hu

Time Allocation of Teaching and Learning Behaviours in Physical Education Classes: A Comparative Study between Greece and Hungary

Marina, I. Salvara

Semmelweis University, Faculty of Physical Education and Sport Sciences,
Department of Sport Pedagogy, Budapest

Abstract

This study examined the allocation of time for teaching and learning behaviours in physical education classes with the use of an observation system created by the author of this paper based on well-defined theory. Participants in this study were 84 physical education teachers, 42 Hungarian and 42 Greek, randomly selected. Teaching experience ranged from 5 to 35 years. Throughout the duration of the study, (2000-2001), teachers were teaching in 4th, 5th and 6th grades of elementary schools in both countries. Teaching and learning behaviours, which were investigated with a multi-exemplar form, focused on basic human abilities: reproduction, discovery and production based on systemic theory. A comparison of the mean time teaching and learning behavioural allocations along with the analyses of videotapes taken were assessed expressing the homogeneity between the two countries. Statistical analyses included chi-square as well as descriptive statistics showing a homogeneous teaching and learning behavioural time allocation in both countries. Validity and reliability of the observational system were examined and the findings suggest that the method of data collection provided a valid and reliable method for investigating instruction in both countries.

Introduction

Physical education teachers have developed, in the course of time, their own personal teaching theories (Bromme, 1984) and compiled their own teaching repertoires of teaching strategies that they prefer to use (Salvara, 2001). This study aimed at revealing this teaching repertoire and finding out whether it can satisfy students' learning styles. Students' het-

erogeneity means that each student learns different things, in a different manner and for different purposes. Furthermore, students can be characterized by different thinking patterns and evaluative orientations for the subject to be learned (Silverman, 1985, 1991). Any physical education curriculum aims at achieving teaching objectives, i.e. psychomotor, cognitive, emotional and participative ones, if it is meant to contribute to students' development (Salvara, 2001). The purposes of this investigation were to 1) to demonstrate the teaching and learning behaviours as recorded during instruction in Athens and Budapest, 2) to identify which teaching and learning behaviours are in the spotlight and 3) to reveal whether they can satisfy students' learning styles.

Theoretical Background

Researching instruction in physical education has many different difficulties, given the complexity of teaching situations. Students are expected to understand and internalise major concepts and principles, but at the same time to acquire intellectual and motor skills that will enable them to distinguish evidence from fantasy and reality from illusion (Tamir, 1991, Gagne, 1964). According to Coker (1996) students have their own ways of learning. For the learning process to be as efficient as possible, teachers could recognize their students' learning modes, and tailor the lesson accordingly. There are four general types of students: visual learners, kinaesthetic learners, thinkers and listeners (Dunn et al., 1989). Physical education teachers need to make decisions in ever-changing situations and perceive pertinent elements of given situations as well as decide upon appropriate teaching strategies and behaviours to be used in order to meet curricular objectives.

During the last decades, a great percentage of research studies in instruction were oriented towards the examination of teaching and learning behaviour (Gustart and Springings, 1989; Silverman, 1991; Fejgin and Hanegby, 1999). Lambdin and Steinhardt (1991) reported linear relationships between teachers' stated goals, their expertise, the taught curriculum, and student achievement, although these assumptions have not been empirically tested. Lawson (1990) has suggested "research needs to consider teachers as individuals who think and act within the context of their own history and current environment" (p. 15) and stressed the need for "multiple research perspectives" (p. 10).

Teachers are accountable for what happens in the class, and they are the primary decision makers. Teachers define tasks for students (Pieron, 1994). A small but growing number of studies in physical education have investigated the effects of teaching behaviour on student learning (Goldberger, 1992; Byra and Marks, 1993; Cai, 1998; Ernst and Byra, 1997; Byra and Jenkins, 1998). However, there has not been an extensive examination of instruction with respect to teaching and learning behaviours time allocation in Greece and Hungary.

Epistemological Framework for the Investigation of Instruction

For this study, an observation system was developed, drawing extensively upon previous and current studies that examined teaching and learning behaviours. The system was organized on three levels; that of *grouping* (what actually happens during instruction and how it is carried out), that of *substance* (which are its characteristic features and what it aims at) and that of *weighing interests* (which is its contribution to the students' development) based on systemic theory. This observational system aspired to reveal the teaching and learning behaviours used

during instruction. There exists a universal agreement in pedagogy implying the ever-existent, constant interaction for the ways of communication and work that occur repeatedly, between teachers and students, which creates networks as well as relations, thus forming a system of teaching interactions (Salvara, 2001).

The concept of teaching as a unifying system of interactions leads towards the definition of the decision-making process, which differentiates the objective, the teaching and learning behaviours, the conditions of subject-matter realization and the students' evaluation criteria. The aforementioned structural elements are organized and realized during the phases of instructions' preparation, main process and evaluation. This depends on the teaching objectives (psychomotor, cognitive, emotional and participative ones), on the kind of knowledge (significative, procedural, genetic), on students' age, their cognitive level and their learning style. The teaching process possesses its own distinctive characteristics, i.e. it is intentionally pre-organized; it is teleological and self-regulated through feedback mechanisms.

Methods

Hypothesis

The main assumption of this study was based on previous investigations carried out by the author (Salvara, 1997) in both countries. The 1997 survey than examined teachers' representations revealed that both Greek and Hungarian teachers tended to use a greater percentage of empiricism (i.e. reproduction of knowledge) then cognitivism (i.e. discovery of knowledge) and to a lesser degree constructivism (i.e. production of knowledge). Nevertheless, Hungarian teachers were found to use a balanced model of the three educational theories during instruction. It is hypothesized that the two countries will not present differences concerning the time allocation of teaching and learning behavioural categories. It is expected that the time allocation of teaching and learning behavioural categories will present a balance for instruction in Budapest based on previous studies (Salvara, 1997).

Participants

The sample is based on time-sampling of 42 Greek and 42 Hungarian physical education classes conducted by different physical education teach-

ers, randomly selected in all together 34 schools from almost all districts in Athens and Budapest. The experience of these teachers ranged from 5-35 years, teaching in 4th-6th grades of elementary schools. This research was based on anonymity of the subjects who participated and a letter explaining the procedures and purposes of this research was distributed to each teacher respectively. For the investigation that was conducted in Hungary, the letter was signed by the dean* of the faculty of the Semmelweis University who significantly contributed to the success of the research.

Instrumentation and Validity

Seventeen categories of teaching behaviours (what the PE teacher does) and learning behaviours (what the student does), that recurred constantly during instruction for each lesson respectively, were recorded. The following describes the categories included:

A. Introduction to instruction:

- 1) Orientation of students' thought
- 2) Questioning situation

B. Continuation to instruction:

- 3) Observation and imitation of the performance pattern
- 4) Discovery under PE teachers' guidance
- 5) Discovery with students' effort
- 6) Creation of multiple solutions
- 7) Planning of an individual exercise program

C. Reconstruction of instruction:

- 8) Work with all the class in a uniform manner
- 9) Individual work
- 10) Reciprocal work
- 11) Work at a selected difficulty level
- 12) Work with self-control
- 13) Discovery application work
- 14) Work with checking the reliability of discovery
- 15) Work with checking the reliability of multiple solutions
- 16) Conduct of the individual exercise program

D. Output of instruction:

- 17) Students' evaluation

Introduction to instruction occurs either with "the orientation of students' thought" (A1) or with the development of "questioning situation" (A2).

Continuation to instruction can occur with each of the categories given B3-B7. Reconstruction to instruction can be performed with either one of the categories from C8-C16 and output to instruction occurs with the "students' evaluation" (D17) for correspondence to the given role. An example of a teaching and learning category is given in Table 1. The categories have a conspicuous position in the various teaching mechanisms and serve as conclusions from empirical research seeking to convert teaching into "apprenticeship". They are totalities, not presented statically but instead function as agencies of a unified action, so that the preceding one, within the limits of each category, determines each subsequent analysis unit. On the other hand, the relationships between the categories form teaching act *sub-systems* (Salvara, 2001). The teaching act sub-systems show a degree of centralising tendency around the mother-concepts: reproduction, discovery, production (Salvara, 2001), which form the overall pursuits of teaching and learning behaviour.

Content validity was established by making all methodological decisions related to data collection and analysis with respect of the theoretical framework that was theorized for studying teaching and learning behaviours (Mosston and Ashworth, 1994; Silverman, 1991; Pieron, 1997; Mancini, 1974). The observational system was reviewed by a panel of university professors (N=4) and school (N=4) physical educators for further content validity and clarity, and appropriate revisions were made.

Teaching and Learning Behaviour

The intervention of physical educators' teaching objectives curriculum, as an a priori condition, mediates in such a way that the decision making of A, B, C, and D observational stages present an asymmetrical relation between teacher and student. Depending on who is making the decisions in the different stages of the teaching act, different teaching strategies are set involving the basic human skills. Teaching expands from a close to an open act and produces different

Table 1. Example: Students' Thinking Orientation Behavioural Category

| Students' thinking orientation |
|--|
| We announce to students the subject matter, which will become the subject for observation and imitation and will be given to students for individual work. We agree on the decisions that students will make, such as exercise sequence, number of repetitions, duration of practise, and state that we are at their disposal for personal feedback. |

kinds of interaction, contributing to students' development in a different manner. This study is limited to the analysis of teaching and learning behaviours and did not expand to the analysis of teaching strategies' application. Mancini (1974) classified teaching behaviour into teacher-centred and student-centred, while Mosston and Ashworth (1994) classified it as a decision-making basis into reproduction and production of knowledge.

Data Collection, Observer Training and Reliability

A total of 84 classes were recorded. Each physical education teacher was observed one time for the entire class time, which was set as 40 minutes and videoed for the same time. During observation, the categories of teacher and student activities were coded simultaneously. A beeper provided auditory and visual stimuli at the end of each and every minute, until the end of the lesson (i.e. until forty minutes). Observer train-

ing included the simultaneous coding of approximately 5 classes (a combination of videotaped sessions and live observations). Data collection did not begin until there was greater than a .90 inter-observer agreement (IOA) achieved between the author and the second coder. The two coders simultaneously observed 14 (16.7%) of the classes for IOA. IOA percentage was established by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 (van der Mars, 1989). A high level of IOA was maintained throughout data collection. The average IOA for this study was 93.2%, with classes ranging from 92.2% to 94.3%.

Data Analysis, Results and Discussion

Data in this study were analysed by the use of descriptive statistics, mean time comparisons, and chi-square analyses. Data analyses were per-

formed with SPSS-statistical package for social sciences- 10.0.1 version (SPSS, Inc., 1999). Chi-square analyses of the data by gender, teaching level and years of experience resulted in non-significant differences. Also chi-square showed no significant differences between the 17 observational categories. The research hypothesis was accepted as supported by the results within this sample. Quantitative descriptions of the time analyses were used to support and amplify the statistical findings. Table 2 with Figure 1 shows the time allocation for teaching and learning behaviours in Athens. It was found that all teaching and learning behavioural categories were allocated with a highly unequal distribution between them. "Students' orientation of thought" (A1=11.9%) during introduction to instruction consumed 2.43 times more instructional time as compared to "students' questioning situation" (A2=4.8%). During continuation to instruction, "observation and imitation of the pattern" consumed double instructional time (B3=23.8%) as compared to the time consumed by altogether "discovery under PE teacher's guidance," "discovery with students' effort," "creation of multiple solutions," and "individual program" (B4, 5, 6, 7=10.1%). During reconstruction to instruction, "work with whole class," "individual work," "reciprocal work," "work with selection of difficulty level" and "work with self-control" (C8, 9, 10, 11, 12=33.2%) consumed 5.19 more instructional time than the "discovery application work," "work with checking on the discovery's reliability," "work with checking on the multiple solutions' reliability" and "conduct of the individual program" (C13, 14, 15, 16=6.4%). During output to instruction, "students' evaluation" consumed a total of 9.8% (D17) instructional time.

Table 3 and Figure 2 show the time allocation for teaching and learning behaviours in Budapest. It was found that all teaching and learning behavioural categories were allocated with a balanced distribution between them. "Students' orientation of thought" (A1=11.9%) during introduction to instruction consumed 2.43 times more instructional time as compared to "students' questioning situation" (A2=4.9%). During continuation to instruction, "observation and imitation of the pattern" consumed double instructional time (B3=17%) as compared to the time consumed by altogether "discovery under PE teacher's guidance," "discovery with students'

Table 2 & Figure 1. Time Allocation of Teaching and Learning Behaviours in Athens

| Observation System Scale Behavioural Categories | N | Mean Time | Total time In minutes | Percent |
|---|----|--------------|-----------------------|---------|
| A1 | 42 | 4,762 | 200 | 11,9% |
| A2 | 42 | 1,905 | 80 | 4,8% |
| B3 | 42 | 9,524 | 400 | 23,8% |
| B4 | 42 | 1,333 | 56 | 3,3% |
| B5 | 42 | 0,786 | 33 | 2,0% |
| B6 | 42 | 0,929 | 39 | 2,3% |
| B7 | 42 | 1 | 42 | 2,5% |
| C8 | 42 | 2,64 | 111 | 6,6% |
| C9 | 42 | 5,1 | 214 | 12,7% |
| C10 | 42 | 2,571 | 108 | 6,4% |
| C11 | 42 | 1,857 | 78 | 4,6% |
| C12 | 42 | 1,143 | 48 | 2,9% |
| C13 | 42 | 0,167 | 7 | 0,4% |
| C14 | 42 | 0,929 | 39 | 2,3% |
| C15 | 42 | 0,429 | 18 | 1,1% |
| C16 | 42 | 1,048 | 44 | 2,6% |
| D17 | 42 | 3,905 | 164 | 9,8% |
| | | Total | 1681 | |

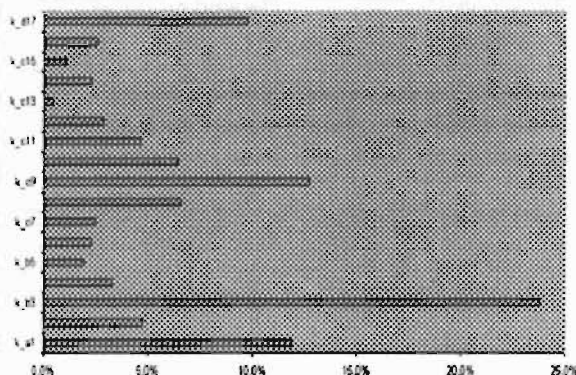


Figure 1.

effort," "creation of multiple solutions," and "individual program" (B4, 5, 6, 7=15.9%). During reconstruction to instruction, "work with whole class," "individual work," "reciprocal work," "work with selection of difficulty level" and "work with self-control" (C8, 9, 10, 11, 12=27.7%) consumed 2.43 more instructional time than "discovery application work," "work with checking on the discovery's reliability," "work with checking on the multiple solutions' reliability" and "conduct of the individual program" (C13, 14, 15, 16=11.4%). During output to instruction, "students' evaluation" consumed a total of 11.2% (D17) instructional time.

Table 4 shows the differences in time allocation that appeared in teaching and learning behavioural categories during each instructional phase. It was found that teaching and learning behaviours present **homogeneity** for each instructional phase. Two flexible instructional sub-systems were revealed as having multiple alternative approaches in their structure.

The first multiple instructional sub-system was found to be in the spotlight of teaching and learning behaviour. This sub-system's characteristic sequence began with the "students' thought orientation" introduction to instruction. Continuation to instruction was presented with the "observation and imitation of the pattern." Reconstruction to instruction accounted more for "individual students' work" or "work with all class" and less with "reciprocal work" or "work at selected difficulty level" and "work with self-control." Output to instruction was accounted for "students' evaluation" in correspondence to the imitated pattern role.

Despite the fact of the homogeneity presented within this sample, which according to Alberti (1986), is due to neo-behaviourist views during the organisation of instruction, quantitative and qualitative differences were found between the two countries. The first multiple instructional sub-system consumed 77.5% of the instructional time

Table 3 & Figure 2. Time Allocation of Teaching and Learning Behaviours in Budapest

| Observation System Scale Behavioural Categories | N | Mean Time | Total time In minutes | Percent |
|---|----|-----------|-----------------------|---------|
| A1 | 42 | 4,738 | 199 | 11,9% |
| A2 | 42 | 1,952 | 82 | 4,9% |
| B3 | 42 | 6,762 | 284 | 17,0% |
| B4 | 42 | 1,548 | 65 | 3,9% |
| B5 | 42 | 1,095 | 46 | 2,8% |
| B6 | 42 | 1,429 | 60 | 3,6% |
| B7 | 42 | 2,238 | 94 | 5,6% |
| C8 | 42 | 2,98 | 125 | 7,5% |
| C9 | 42 | 3,71 | 156 | 9,3% |
| C10 | 42 | 1,667 | 70 | 4,2% |
| C11 | 42 | 1,881 | 79 | 4,7% |
| C12 | 42 | 0,786 | 33 | 2,0% |
| C13 | 42 | 0,238 | 10 | 0,6% |
| C14 | 42 | 1,786 | 75 | 4,5% |
| C15 | 42 | 0,595 | 25 | 1,5% |
| C16 | 42 | 1,929 | 81 | 4,8% |
| D17 | 42 | 4,476 | 188 | 11,2% |
| Total | | | 1672 | |

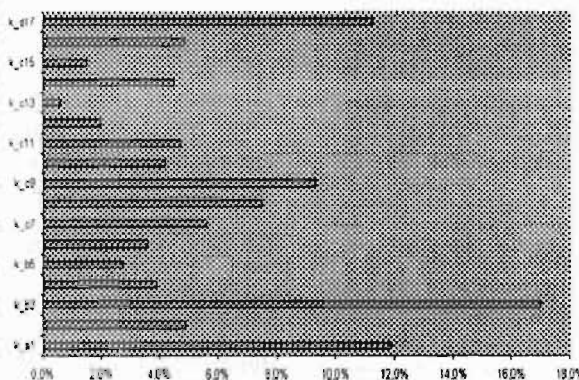


Figure 2

in Athens, while in Budapest it consumed 65.5%. In this instructional sub-system prevailed those teaching and learning categories that according to Mosston and Ashworth (1994), aim for the reproduction of knowledge. This sub-system focuses on one and only correct way of exercise performance through imitation; it demands increased practise time; it uses the functions of memory and recall; it limits the process of feedback to the perfect imitation of the given execution and does not

accept students' individual differences. This sub-system creates a kind of imperative acquiescence in the instructional climate (Goldberger, 1992).

The second multiple instructional sub-system was found to be in the background of teaching and learning behaviour. The sub-system's characteristic sequence began with "students' questioning situation" during introduction to instruction. Continuation to instruction was presented with "discovery under PE teacher's guidance," "discovery with students' effort," or with "creation of multiple solutions" and "individual program." Reconstruction to instruction was accounted more with "discovery application work," "work on the discovery's reliability," or with "work on multiple solutions' reliability" and "conduct of the individual program." Output to instruction was accounted for "students' evaluation" in correspondence to the degree a transgression made of the already known with the production

Table 4. Instructional Time Allocation Differences of Teaching and Learning Behavioural Categories

| Teaching and Learning Behavioural Categories | Total Time in Minutes | Athens Mean | % | Total Time in Minutes | Budapest Mean Time | % |
|--|-----------------------|-------------|------|-----------------------|--------------------|------|
| A 1 | 200 | 4.76 | 11.9 | 199 | 4.73 | 11.9 |
| A 2 | 80 | 1.90 | 4.8 | 82 | 1.95 | 4.9 |
| B 3 | 400 | 9.52 | 23.8 | 284 | 6.76 | 17.0 |
| B 4, 5, 6, 7 | 170 | 4.04 | 10.1 | 265 | 6.31 | 15.9 |
| C 8, 9, 10, 11, 12 | 559 | 13.31 | 33.2 | 463 | 11.02 | 27.7 |
| C 13, 14, 15, 16 | 108 | 2.57 | 6.4 | 191 | 4.54 | 11.4 |
| D 17 | 164 | 3.90 | 9.8 | 188 | 4.47 | 11.2 |

of multiple solutions. The second multiple instructional sub-system consumed 22.5% of the instructional time in Athens, while in Budapest consumed 34.5%. In this instructional sub-system those teaching and learning behavioural categories that according to Mosston and Ashworth (1994), aim for the production of knowledge prevailed. This sub-system's focus is on the construction of teaching strategies. Alternative solutions for the planning and execution are offered: it consumes increased instructional time for solutions' control; it uses advanced cognitive functions such as comparing, contrasting, and categorising the solutions of problems aiming at transformation and restructuring of prior knowledge. Feedback is directed towards production and control of multiple solutions through movement; it pursues individual differences in quantity, in rhythm and in the kind of production. This sub-system's creates a researching instructional climate through the examination of multiple solutions and through the transgression of already known (Goldberger, 1992).

In comparison to teachers in Athens, physical education teachers in Budapest present a better application analogy concerning both multiple instructional sub-systems. Given Goldberger's (1992), contention that the second multiple instructional sub-system' teaching and learning behaviours have been claimed to be "virgin fields" in physical education's instruction, the two countries can therefore be characterised as being on a good level concerning the form with which the instructional products are presented.

In conclusion, the findings in this study extend previous work in this area and further underscore the importance of the variety of teaching and learning behaviours used during instruction. One of the most important things we can do as physical educators is to instill a love for physical activity and strive to improve the likelihood of our students engaging in and sustaining a more active lifestyle as mentioned by several current studies (Blair, 1993; Siedentop and Tannehill, 2000; Kovar et al., 2001). The teaching strategies and behaviours we choose as teachers can have a significant impact during the long-term process (Mosston and Ashworth, 1994).

References

- Blair, S. N. (1993). 1993 C. H. McCloy Physical Activity, Physical Fitness and Health. *Research Quarterly for Exercise and Sport*, 64: 365-376.
- Bromme, R. (1984). On the limitations of the theory metaphor for the study of teachers' expert knowledge. In: R. Halkes and J. Olson (eds.), *Teaching Thinking*. Lisse.
- Byra, M., & Jenkins, J. (1998). The thoughts and behaviours of learners in the inclusions style of teaching. *Journal of Teaching in Physical Education*, 18(1): 26-42.
- Byra, M., & Marks, M. (1993). The effect of two pairing techniques on specific feedback and comfort levels of learners in the reciprocal style of teaching. *Journal of Teaching in Physical Education*, 12(2): 286-300.
- Cai, X. S. (1998). Student enjoyment of physical education class in three teaching styles environments. *Education*, 118(3): 412-420.
- Coker, C. A. (1996). Accommodating students' learning styles in physical education. *JOPERD*, 67(9): 66-69.
- Dunn, R., Beaudry, J. S., & Klavis, A. (1989). Survey of research on learning styles. *Educational Leadership*, 46(6): 50-58.
- Ernst, M., & Byra, M. (1997). Pairing learners in the reciprocal style of teaching: Influence on student skill, knowledge, and socialization. *The Physical Educator*, 55(1): 24-37.
- Fejgin, N., & Hanegby, R. (1999). Physical educators' participation in decision-making processes in dynamic schools. *Journal of Teaching in Physical Education*, 18(2): 141-158.
- Gagné, R. M. (1964). The implications of instructional objectives for learning. In: Lindvall, C. M. (ed.). *Defining educational objectives*. (p. 89) University of Pittsburgh Press, Pennsylvania.
- Goldberger, M. (1992). The spectrum of teaching styles: A perspective for research on teaching physical education. *JOPERD*, 63(1): 42-46.
- Gustart, J. L., & Springings, E. (1989). Student learning as a measure of teacher effectiveness in physical education. *Journal of Teaching in Physical Education*, 8: 298-311.
- Kovar, S. K., Emler, K. L., Mehrhof, J. H., & Nepper-Owen, G. E. (2001). Choosing activity units to promote maximum participation: Creative physical education curricula. *The Physical Educator*, 58(3): 114-123.
- Lambdin, D. D., Steinhardt, M. A. (1991). Elementary and secondary physical education teachers' perceptions of their goals, expertise, curriculum, and students' achievement. *Journal of Teaching in Physical Education*, 11(2): 103-111.
- Lawson, H. A. (1990). Sport pedagogy research: From information gathering to useful knowledge. *Journal of Teaching in Physical Education*, 10:1-20.
- Mancini, O. (1974). *A comparison of two decision-making models in an elementary human movement program based on attitudes and interactions patterns*. Unpublished doctoral dissertation, Boston University.
- Mosston, M., Ashworth, S. (1994). *Teaching physical education*. (pp. 17-64) NY: Macmillan Publishing Company.
- Pieron, M. (1994). Studying the instructional process in teaching physical education. *Sport Science Review*, 3(1): 73-82.
- Salvara, M. (1997). *Physical education teachers' representations for their teaching work: A comparative study between Greece and Hungary*. Unpublished thesis, Semmelweis University, Faculty of Physical Education and Sport Sciences.
- Salvara, M. (2001). Structuring a spectrum of teaching strategies for instruction in physical education. *Mentor Journal*, 3(3): 126-145.
- Siedentop, D., & Tannehill, D. (2000) *Developing teaching skills in physical education* (4th ed.). Mountain View, CA: Mayfield.
- Silverman, S. (1985). Relationship of engagement and practice trials to student achievement. *Journal of Teaching in Physical Education*, 5: 13-21.
- Silverman, S. (1991). Research on teaching in physical education. *Research Quarterly for Exercise and Sport*, 62: 352-356.
- Tamir, P. (1991). Reforms in Science Education. In: Lewy, A. (ed.) *The international encyclopaedia of curriculum*. (pp. 899-901) Oxford: Pergamon Press, England.
- Van der Mars, H. (1984). Observer reliability: Issues and procedures. In: P. Darst, D. Zakrajsek, & V. Mancini (eds.), *Analysing physical education and sport instruction* (pp. 53-79). Champaign, IL: Human Kinetics.

Acknowledgements

*The author would like to thank Prof. Dr. J. Tihanyi. The author would also like to thank Prof. Dr. E. Birü for supervising and guiding this research and at last, but not least, many thanks to Prof. Dr. S. Bandy for editing this manuscript.

Examinations of Motor Skill in Kindergarten Children

Óvodás gyermekek mozgásügyességének vizsgálata

Sándorné Gaál - István Farnosi*

Kindergarten Teachers Faculty Tessedik Samuel College, Szarvas
*Semmelweis University, Faculty of Physical Education, Budapest

Abstract

1517 Children – 751 boys and 766 girls of to 5-7 years age – were examined concerning their motor skill. It was found that physical advancement of children reaches, or more exactly exceeds the home references by 50 percent. Their physical advancement is a good base for the physical performances. Evaluated the motor skill of children it was found that in this age interval the girls are better in balancing compared to the boys. The growth rate of girls is also higher than that of the boys. These results are interpreted as characteristics of motion development at the end of the small child age. Uniform development rate was observed in running with evasion and in the two tests elaborated by our group, the boomerang running and the obstacle course. Reliability and validity of both tests were qualified excellent expect for one case. They are both recommend for practical use.

Key-words: motor skill, kindergarten age

Összefoglaló

1517 5-7 éves óvodás gyermeket, 751 fiút és 766 lányt vizsgáltunk a mozgásügyesség szempontjából. Megállapíthattuk, hogy a gyermekek testi fejlettsége eléri, illetve meghaladja a hazai referencia 50 –es percentilisének. Testi fejlettségük megfelelő alapot ad a motorikus teljesítményhez. Mozgásügyességüket értékelve azt találtuk, hogy az egyensúlyozásban erre az életkorra jellemző a lányok jobb teljesítménye a fiúkéhoz képest. A lányok fejlődési üteme is meghaladja a fiúkét. Egyenletes fejlődési ütemet figyeltünk meg a kerülő futásnál, valamint az általunk kidolgozott két tesztnél a bumeráng futásnál és az akadálypályánál. Mindkét teszt megbízhatósága és érvényessége meghaladja, egy eset kivételével a kiváló minősítést jelentő értéket.

Kulcsszavak: mozgásügyesség, óvodáskor.

Introduction

In the recent years the motor skill as well as its changes and components have been studied in 2805 kindergarten age children (Farnosi - Gaálné, 2000). As a result of these studies it was found that the physical power of kindergarten age children is determined not only why conditional capacities which support the power but mainly by the level of basic forms of motion or the ability to perform motions. Based on these studies it was or also supposed that in kindergarten age the differences in physical power can be explained by the differences of skill ability. Followed this observation it was decided to study the motor skill of the given age group or more exactly to try two different tests which are utilisable for complete characterisation of this feature of children. The present study demonstrates the results of the above-mentioned examination.

Materials and methods

Examined persons

During the academic year 2000//2001, 1517 children - 751 boys and 766 girls - were examined by the help of kindergarten teachers in 121 kindergartens of different settlements of the country. Besides the capital there were chief towns of countries smaller and bigger towns and villages among the settlements of examinations. The ages and sex distribution of the examined persons as well as the averages in different ages are given in Table 1.

Method of examinations

The methods of examinations can be divided into two groups: the examinations of body dimensions and the tests of physical power. Two body dimensions, i.e. the height and body mass were measured using the rules of anthropometry. By collecting these data our aim was to determine the

body development of children as such a background variable which may influence the physical power.

The motor skill was characterised by four tests. Two of them were Fleischman's running with evasion and standing on one foot which were used as standard tests while the other two tests – the boomerang running and the obstacle course – were our own methods.

Boomerang running: A quadrangle (100x150 cm) area was created the corners and the centre of which was marked. At each corner of the area a medicine ball was positioned. To four directions from the centre through the midpoint of the sidelines, at 200cms, suitable objects were placed. The exercise was as follows: children ran from the medicine ball to the object located at 200cms distance, and going round it they proceeded towards the direction of the next medicine ball. Approaching it they started crawling (hands and feet on the floor), went around it, then stood up and started going towards the next ball. Each medicine ball and each object at 2m distance had to be gone around. The test was over, when the children returned and crossed the starting line in a crawling position, having gone around the 4th medicine ball (that is where they started from). (Figure 1.) Time was measured to 0.1 accuracy. The children completed the course twice in the same order. The result of both experiments was recorded.

Obstacle course: The following course was built: Five medicine balls were set up at 1.5 m from the starting line, and at each 1 m from that. A 50cm high obstacle (it could be a bar) was set up at 1 m from the last medicine ball, then a small table (used at kindergartens). One 40cm high obstacle was also positioned in line with the one on the other side. At 2.5m distance from this obstacle two balls were placed 2 metres far from each other. The imaginary line connecting the two balls was at the right angle to the direction of the progress. Another obstacle, a mat was positioned proportionally on the remaining distance, in one line with the starting line. (Figure 2.) The completion of the obstacle course was as follows: To a signal, children ran

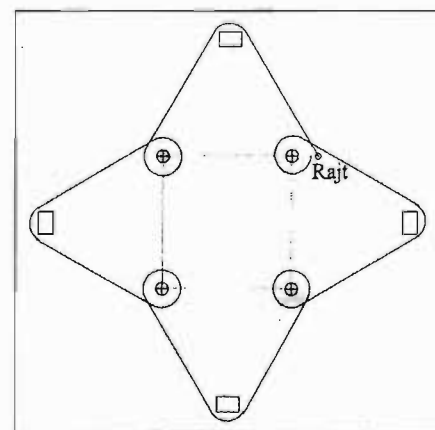
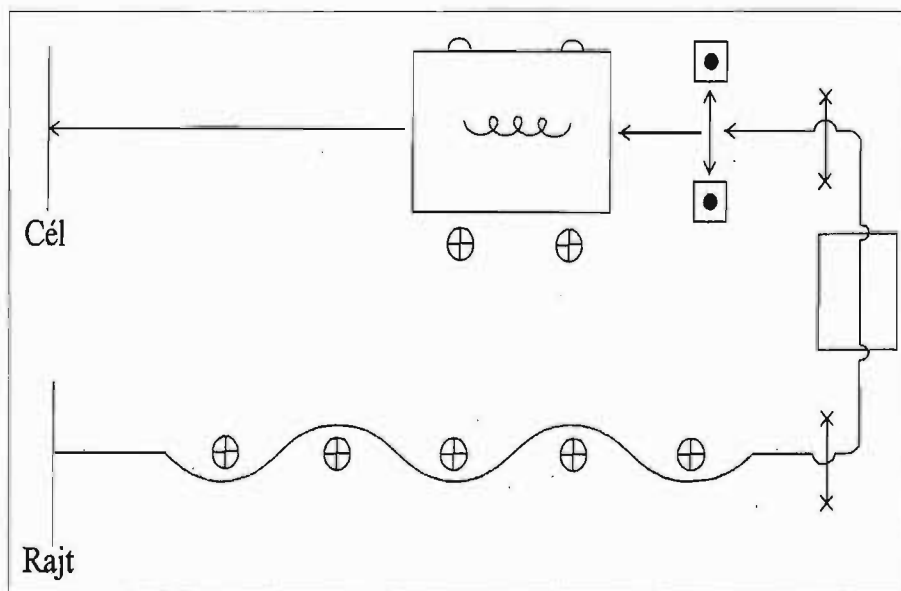


Figure 1. Boomerang running
1. ábra Bumerángfutás

Figure 2. Obstacle course
2. ábra Akadályfutás

between the medicine balls with slalom, then passed under the first obstacle. Then they turned and jumped onto the small table, crawled along the surface, then turned round and jumped off at the other end. Then having made a turn, they stepped over the second obstacle, and slid along in a sitting position up to the line of the balls. They stood up, changed the two balls, and rolled along the mat to its other side. Then they stood up and ran to the finish. The exercise could be executed only once before the testing. The leader of the experiment explained the next part of the exercise during the execution. The time was measured to 0.1 accuracy. The children had to cover the course twice and both of them were recorded.

Data processing

The basic statistical data: the average, standard error, dispersion, variation coefficient as well as minimum and maximum values were calculated after checking the accuracy of data. Then the correlation between the analysed parameters was calculated and a factor analysis was carried out. From the latter one only the weight factor was used to characterise the validity of own tests.

Results

Body advancement of examined children

The body advancement connected to the examination of motor skill characterised by the comparison of height and body mass to the standard values. As a result of the comparison it is possible to evaluate the power of motion referring to different levels of somatic condition and development. Finally it

also be identified if the somatic and motor development are parallel to each other. However for this purpose it is necessary to get the standard values of motor power.

The statistical data of height are shown in Table 2. Significant dispersion and variability were found neither in boys and girls nor in the different age groups. It is obvious that the five and six years old boys are taller than the girls of the same age, while the average values of seven-year-olds are practically the same.

As compared to the home standard values (Eiben *et al.*, 1991), the averages of five- and six-year-olds are 50% higher both in boys in girls but the averages of seven-year-olds are identical.

The increase in height during kindergarten age – i.e. the difference in height of 5- and 7-year-olds – is 8.5 cm in boys and 9.85 cm in girls. In our previous examinations (Famosi - Gaálné, 2000) this difference was 10.3 cm in girls and 10.8 cm in boys. This difference can be explained by the slower rate of development only in boys but it is more likely that the difference comes from the lower number of samples and random sampling.

The *body mass* is more sensitive to the effects of environment – e.g. the nutrition, way of life and regular exercise – than the height. Therefore its variability is also higher (see the dispersion and the variation coefficient) than that of height. The minimum and maximum values also refer to the fact that in the samples there are both underfed and overfed children. It is well known that the bigger body mass, i.e. the adiposis is disadvantageous from point of view of some motions. Thus the bigger variability of body mass may cause bigger variations of the motor

power. The statistical data of body mass are demonstrated in Table 3.

If five to six years age the body mass of boys is bigger than that of girls – as it was found in height as well. In seven years age the body mass is the same in both sexes. Compared to the home reference values (Eiben *et al.*, 1991), it was found that the values of 5- to 6-year-old boys and 5-year-old girls are 75% higher while those of 7-year-old boys and 6- to 7- years old girls are 50% higher.

The mass increase – i.e. the difference between the 5-to 7-year-olds – is 3 kg in boys and 3.69 kg in girls. In our previous examination 3.8 kg and 3.9 kg differences were found (Famosi - Gaálné, 2000). The difference in mass increase between the two samples – as it was described in height as well – may come from the difference of samplings. The difference may also be caused by the fact the difference between the average ages of six-year-olds was only 0.7 year (see Table 1.). During the missing 0.3 year, that is 3-3.5 month, the children possibly grew further or more exactly their mass increased, thus the differences between the 5- and 7- year-olds would be similar to those of the earlier examination.

Finally in can be concluded that the examined children have been in good state of bodily advancement thus it could not be a limiting factor from point of view of physical power.

Motor skill of examined children

As it was mentioned the above paragraph of methods, the motor skill of children was studied in four tests. Among them the balancing (standing on one foot) and running with evasion

are well-known. The later one requires the ability of good sense of locality and the ability for reorganisation of motion. The so-called boomerang running elaborated by our team for the kindergarten conditions is similar to it. Finally it has been found that all coordination abilities should have been used for accomplishment of the obstacle course.

Balancing. The statistical data of tests are shown in **Table 4**. Significant relative dispersion is observed both in boys and in girls, i.e. the samples are highly variable. The balancing power improves continuously between the age of five and seven years. The balancing power of boys improves by 5.33 s during the two years while that of girls improves by 6.41 s and between six and seven years age the power of girls exceeds that of boys. In our earlier examination (Farmosi - Gaálné, 2000) as well as in studies of Bakonyi - Nádori (1978) and Bakonyi (1981) the same parameters were observed. The better balancing capacity of girls compared to that of boys near the end of the small child age may be interpreted as a peculiarity of development of motion in girls - of course with a very wide range of variability.

Running with evasion. The statistical data are shown in **Table 5**. It was found that the average power connected to the different ages improved continuously. The total development of boys (4,94 s) during the two years was bigger than that of girls (4,33 s). It may come from the fact that the boys have a bigger power in any age than the girls. Gyóri (1992) had similar outcomes in his examinations of four to six years old children. The results of boys were higher in the Veszprém kindergarten as well. Their growth rate was also higher in that examination.

Boomerang running. The statistical data show an improvement of 3.2 s in boys and 2.51 s in girls between the age of 5 and 7 years (**Table 6**). The difference between the end values and the relative dispersion resulting from it, are bigger than the values found in

running with evasion. It allows to come to the conclusion that this test is more complicated for this age group than running with evasion.

In both sexes the relative dispersion in 7 years age was bigger than in the previous ages. It induces the idea that the dimension of the test-field should be modified because of the height increase in the period between the 5 and 7 years age, as in our examinations this height increase was 8.5 cm in boys and 9.85 cm in girls. It is supposed that evasion of objects which are close to each other is difficult for the taller children especially when they have to go round the objects on their hands and knees.

Obstacle course The statistical data shown in **Table 7**. The changes of averages depending on the age are uniform, however the improvement is higher between the age of 5 and 6 years lower between the age of 6 and 7 years. Boys show better performance in every age but the total development is bigger in girls (boys: 6,09 s, girl: 6,25 s). Although the relative dispersion is acceptable, the end values demonstrate that there are very clever and very clumsy children in the sample as well.

Reliability and validity of tests

In elaboration of new tests it is fundamental to analyse these two characteristics. Reliability means that the results do not change in the repeated tests within one time interval. Validity means that the test measures actually that parameter for which it has been elaborated. Both are considered good if the correlation coefficient is higher than

0.8 while the value higher than 0.85 means excellent qualification (Nádori, et al., 1989). For evaluation of validity we used "factorial validity" as similar tests result of kindergarten age which could be used as criteria have not been found. For reliability the method of tests and retest was applied. The relevant data are shown in **Table 8**.

The bold values show the reliability while the values in italics show the validity. It can be stated that these values are excellent in all these ages, in both tests and both in boys and in girls. Thus these test are suggested for examinations of motor skill of kindergarten age children.

References

- Bakonyi F. (1981): A 3-6 éves óvodások testi fejlődése, fizikai erőnléte és motorikus szintje. TSTT, Bp. 185.
- Bakonyi F. - Nádori L. (1978): Adatok a 4-12 évesek mozgáskoordinációjának életkori szintjeihez. Tanulmányok a TFKI kutatásaiból 1977-1978. TF. Bp. 1978.
- Eiben O. - Pantó E. - Barabás A. (1991): National Growth Study. Humanbiologia Budapestensis 21. Budapest. 123.
- Farmosi I. - Gaál S.né (2000): Óvodások testi fejlődése, fizikai teljesítménye és motorikus struktúrája. In: www@threef.hu/ovodasok.html
- Gyóri P. (1992): Óvodás gyermekek motoros képességeinek kutatási eredményei. VEAB, Veszprém. 22-43.
- Nádori L. - Derzsy B. - Fábrián Gy. - Ozsváth K. - Rigler E. - Zsidi M. (1989): Sportképességek mérése. Sport, Bp. 351.

Table 1. Age and sex distribution of children (The average age of the given age group is shown in brackets.)

1. táblázat. A vizsgált gyermekek megoszlása életkor és nem szerint (Zárójelben az adott korosztály életkori átlaga)

| Age | Boys | Girls | Total |
|-----------------|------------|------------|-------------|
| Five-year-olds | 210 (5.09) | 225 (5.08) | 435 |
| Six-year-olds | 316 (6.06) | 325 (6.05) | 641 |
| Seven-year-olds | 225 (6.79) | 216 (6.79) | 441 |
| Total | 751 | 766 | 1517 |

Table 2. Height

| Age | x | sx | s | min. | 2. táblázat. Testmagasság | |
|--------------|--------|------|------|-------|---------------------------|------|
| | | | | | max | v |
| Boys | | | | | | |
| 5-year-olds | 113,28 | 0,42 | 6,01 | 93,5 | 129,0 | 5,31 |
| 6-year-olds | 118,76 | 0,33 | 5,87 | 100,0 | 135,5 | 4,94 |
| 7-year-olds | 121,78 | 0,37 | 5,57 | 107,0 | 136,0 | 4,57 |
| Girls | | | | | | |
| 5-year-olds | 111,88 | 0,40 | 6,06 | 98,0 | 137,0 | 5,42 |
| 6-year-olds | 117,67 | 0,34 | 6,06 | 99,5 | 135,0 | 5,15 |
| 7-year-olds | 121,73 | 0,40 | 5,81 | 100,0 | 138,5 | 4,77 |

| Age | X | sx | s | min. | max | v |
|-------------|-------|------|------|------|------|-------|
| Boys | | | | | | |
| 5-year-olds | 20,03 | 0,22 | 3,24 | 12,5 | 31,0 | 16,19 |
| 6-year-olds | 22,14 | 0,21 | 3,68 | 13,5 | 39,5 | 16,63 |
| 7-year-olds | 23,04 | 0,25 | 3,88 | 13,0 | 45,5 | 16,85 |
| Girls | | | | | | |
| 5-year-olds | 19,33 | 0,23 | 3,49 | 12,5 | 34,0 | 18,03 |
| 6-year-olds | 21,63 | 0,23 | 4,11 | 13,0 | 45,0 | 19,03 |
| 7-year-olds | 23,02 | 0,28 | 4,05 | 12,5 | 41,0 | 17,59 |

| Age | X | sx | s | min. | max. | v |
|-------------|-------|------|-------|------|------|-------|
| Boys | | | | | | |
| 5-year-olds | 30,00 | 0,91 | 13,44 | 10,0 | 60,0 | 43,75 |
| 6-year-olds | 32,88 | 0,89 | 15,85 | 10,0 | 60,0 | 48,21 |
| 7-year-olds | 35,36 | 1,12 | 16,84 | 12,0 | 60,0 | 47,60 |
| Girls | | | | | | |
| 5-year-olds | 30,10 | 0,94 | 14,14 | 10,0 | 60,0 | 46,90 |
| 6-year-olds | 34,36 | 0,85 | 15,39 | 10,0 | 60,0 | 44,79 |
| 7-year-olds | 36,51 | 1,11 | 16,39 | 10,0 | 60,0 | 44,89 |

| Age | X | sx | s | min. | max. | v |
|-------------|-------|------|------|------|------|-------|
| Boys | | | | | | |
| 5-year-olds | 33,31 | 0,51 | 7,58 | 17,9 | 59,0 | 22,15 |
| 6-year-olds | 31,13 | 0,40 | 7,03 | 15,2 | 57,0 | 22,57 |
| 7-year-olds | 28,37 | 0,52 | 7,75 | 12,0 | 55,9 | 27,30 |
| Girls | | | | | | |
| 5-year-olds | 34,06 | 0,51 | 7,71 | 16,2 | 57,8 | 22,62 |
| 6-year-olds | 31,57 | 0,42 | 7,65 | 11,0 | 64,1 | 24,23 |
| 7-year-olds | 29,73 | 0,51 | 7,50 | 12,5 | 56,0 | 25,23 |

| Age | X | sx | s | min. | max. | v |
|-------------|-------|------|------|------|------|-------|
| Boys | | | | | | |
| 5-year-olds | 25,70 | 0,47 | 6,83 | 13,0 | 49,0 | 26,61 |
| 6-year-olds | 24,96 | 0,42 | 7,62 | 10,9 | 59,0 | 30,54 |
| 7-year-olds | 22,50 | 0,46 | 6,93 | 13,0 | 60,0 | 30,83 |
| Girls | | | | | | |
| 5-year-olds | 25,90 | 0,49 | 7,33 | 10,8 | 53,0 | 28,31 |
| 6-year-olds | 24,79 | 0,37 | 6,70 | 10,4 | 50,2 | 27,05 |
| 7-year-olds | 23,39 | 0,45 | 6,72 | 14,5 | 48,0 | 28,76 |

| Age | X | sx | s | min. | max. | v |
|-------------|-------|------|------|------|------|-------|
| Boys | | | | | | |
| 5-year-olds | 32,9 | 1,25 | 7,43 | 23,2 | 15,4 | 22,55 |
| 6-year-olds | 28,56 | 0,83 | 6,61 | 15,4 | 50,2 | 23,13 |
| 7-year-olds | 26,95 | 1,17 | 6,42 | 15,0 | 42,0 | 23,84 |
| Girls | | | | | | |
| 5-year-olds | 31,74 | 1,38 | 19,9 | 19,9 | 58,9 | 26,82 |
| 6-year-olds | 29,82 | 0,99 | 7,58 | 18,6 | 56,9 | 25,42 |
| 7-year-olds | 27,02 | 0,99 | 5,36 | 17,0 | 39,1 | 19,82 |

Table 8. Reliability and validity of boomerang running and obstacle course tests
8. táblázat. A bumerángfutás és az akadálypálya teszt megbízhatósági és validitási értékei

| Age | Boomerang running | | | | Obstacle course | | | |
|-------------|-------------------|------|-------|------|-----------------|------|-------|------|
| | Boys | | Girls | | Boys | | Girls | |
| 5-year-olds | .886 | .931 | .947 | .931 | .869 | .937 | .941 | .937 |
| 6-year-olds | .948 | .977 | .883 | .951 | .958 | .993 | .911 | .981 |
| 7-year-olds | .960 | .971 | .817 | .888 | .942 | .979 | .928 | .934 |

A Possible Motor Learning Concept in Sports

Zoltán Vass, Mátyás Varga

Semmelweis University Faculty of Physical Education, Department of Psychology, Budapest

Abstract

Over the last 15 years researchers have tried to explain the differences between experts and non-experts in processing the acquired information by means of more cognitive "software" dimensions. In general, it has been shown that expertise in more cognitive domains such as chess or solving of mathematical problems, is based on the acquisition of, the rapid access to, and the efficient use of semantically rich and, therefore complicated networks of domain-specific declarative and procedural knowledge (Neuman, O. 1996) This experiment is addressed to detect the differences between the expert and non-expert dart players in different kind of information processing. 12 darts player participated in this experiment, throwing their darts in four different environmental conditions. The added information about the performance were continuously diminished from task by task, which means at first, participants were allowed to use both visual and kinesthetic information during executing but at last only the kinesthetic information can be used. According to our results expert players were able to perform stable performance not depending on the decrease of environmental information. Opposing to this, non-expert were not able to perform so stable. It means that experts have developed a special knowledge or special motor program to execute the throwing performance so constantly during the learning period.

Keywords: psychomotor development, motor control, specificity, motor program, kinesthetic information

Összefoglaló

Az elmúlt 15 évben a kutatók számtalanszor próbálták megmagyarázni, és tudományos igénnyel értelmezni a kezdő és professzionális sportolók között jelentkező információ feldolgozási különbséget. Általánosságban arra a megállapításra jutottak, hogy a kognitív jártasságot igénylő jártasságokban

mint a sakk, vagy a matematikai problémák megoldása elsősorban az elsajátításon, a gyors információ elérésén, valamint a deklaratív és procedurális tudás használatban rejlik. Jelen kísérletünkben arra vagyunk kíváncsiak, vajon milyen különbségek adódnak a profi és amatőr dart játékosok között az információfeldolgozás terén. 12 dart játékos vett részt a kísérletben, ahol a feladat végrehajtásáról közölt információkat (eredményesség) feladatra csökkentettük. Ennek értelmében az első feladatban normál körülmények között kellett a dobásokat végrehajtani ez azt jelenti, hogy az első feladathoz mind a vizuális és kinezetikus információt használhatták a kísérlet alanyai a célzás és a végrehajtás alatt. Ezzel szemben az utolsó feladatban már csak a kinezetikus információkra hagyatkozva kellett végrehajtani az adott dobást. A kísérlet eredményei alapján arra az álláspontra jutottunk, hogy csak a profi dart játékosok voltak képesek teljesítménycsökkenés nélkül végrehajtani a feladatot, tehát sikeresen kompenzálták az információ csökkenéssel járó veszteséget. Ezzel szemben a kezdő játékosok nem voltak képesek a feladatban szereplő zavaró tényezők kiküszöbölésére, ami a

jelentős teljesítmény csökkenésben mutatkozik meg. A kutatási eredmények továbbá alátámasztják az általunk felvetett generalizált motoros program és motoros program elkülönítésének jogosultságát, miszerint a profi játékosok azért voltak képesek teljesítmény csökkenés nélkül végrehajtani a feladatokat, mert a hosszú tanulási folyamat alatt egy speciális ún. motoros programot fejlesztettek ki, ami csak sok év tapasztalattal és gyakorlással szerezhető meg.

Kulcs-szavak: pszichomotoros fejlődés, mozgásszabályozás, specifikuság, motoros program, kinezetikus információ

Introduction

A fundamental assumption in the area of motor control is that movements are organized centrally in the form of motor program (Henry, F. M. and Rogers, D.E. 1960). Evidence for this idea comes from studies that show the entire movements can be executed in the absence of peripheral feedback. These findings undermined early S-R learning theories which posited that each component of a given movement was elicited by the feedback caused by the component movement immediately preceding it. Instead, these results suggested that the central nervous

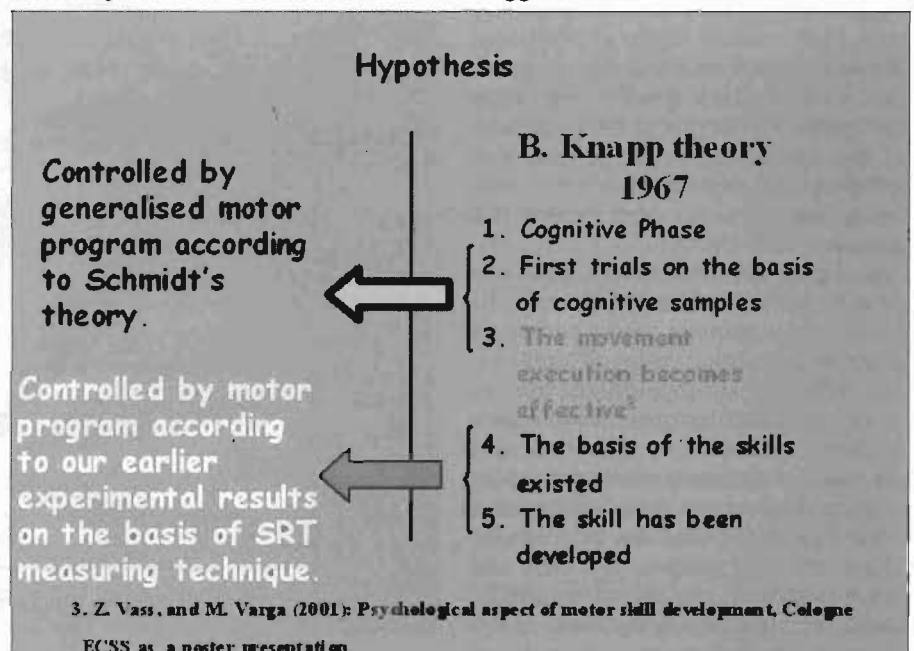


Figure 1.

Hypothesis on the basis of B. Knapp Theory

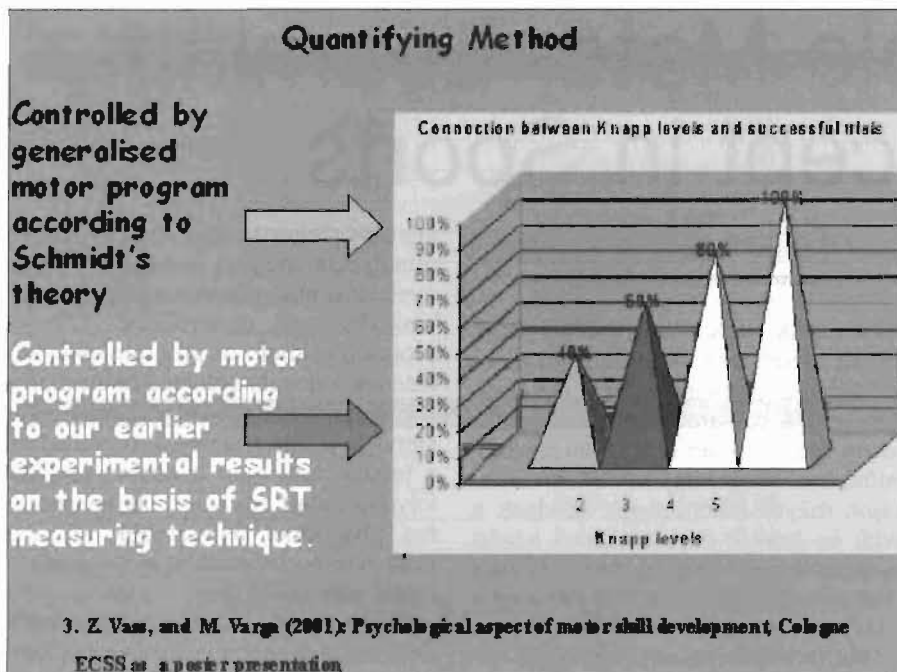


Figure 2. Performance quantifying method to evaluate the proficiency of the participants

system creates a sort of "master plan" (Schmidt, R.A. 1975) then can be implemented often without a great deal of on-line control (Keele, 1981). Motor programs are made up of several elementary components. That is when constructing a particular motor program, an individual must specify where, when, and with how much force each movement will occur (Gao, I. & Zelaznik, H.N. 1991). Before implementing this plan, however the central nervous system must integrate the information that is given by the timing, force, and sequencing modules. A long-standing debate in the field of motor control concerns the role of general underlying abilities in constraining task performance. While a great deal of research suggests that motor expertise is largely task-specific. We argue that motor learning is at the beginning of the process is more general rule learning, and becoming professional, motor learning is no more general but specific.

In this experiment as well as in our earlier ones B. Knapp (Knapp B. 1968) motor learning theory served as a theoretical basic point (Figure 1). According to our hypothesis, movement controlled by generalised motor program at the first three learning stages. In the consequence of this participant need mostly visual information (Pew, R.W. 1974) and less kinaesthetic information to perform. It means the movement execution is not automatic and it requires more attention to reach the best result, which is even lower than the professionals. When partici-

pants use only generalised motor program to control their movements, they are not able to do it in high level because this generalised motor program consists only general parameter about movement. At the last two highest stages movement controlled by motor programs, which were developed due to long learning process. These stages can be characterised as a development of a special motor program to control on most precise way their movements. At these stages motor program consist special parameter so participants are able to use their kinaesthetic information as good as visual information to perform. This

shift from the visual information to the kinaesthetic information can be realized at the third stage what we can call the formation of co-ordination. It begins with the development of smoothness due to decreased excitatory process in the CNS (Puni, A.C. 1965). The so-called "reflex connections" are appeared. In the structure of movement the harmony and accuracy play important role. The kinaesthetic information progressively connects to the conscious control of the movement.

Methods

To check the information processing differences between expert and non-expert darts players, different kind of throwing conditions were found out and participant were asked to perform the best as they can with maximal motivation. Participants had to throw 30 darts in each tasks and the successful and unsuccessful attempts ratio and the standard deviation was measured. Into the required area a yellow marker was placed and the aim was to throw the darts as close as possible. The distance between the yellow marker and the thrown darts was measured by a special ruler. According to this before collecting the data a special quantifying method were developed, which were used in our earlier experiments (Z. Vass, M. Varga 2001). According to that (Figure 2) if a participant performed 80 % or higher we marked the performance level with 5. If a participant performed between 60%-80% we marked the performance level 4 and so on. Parallel to this we

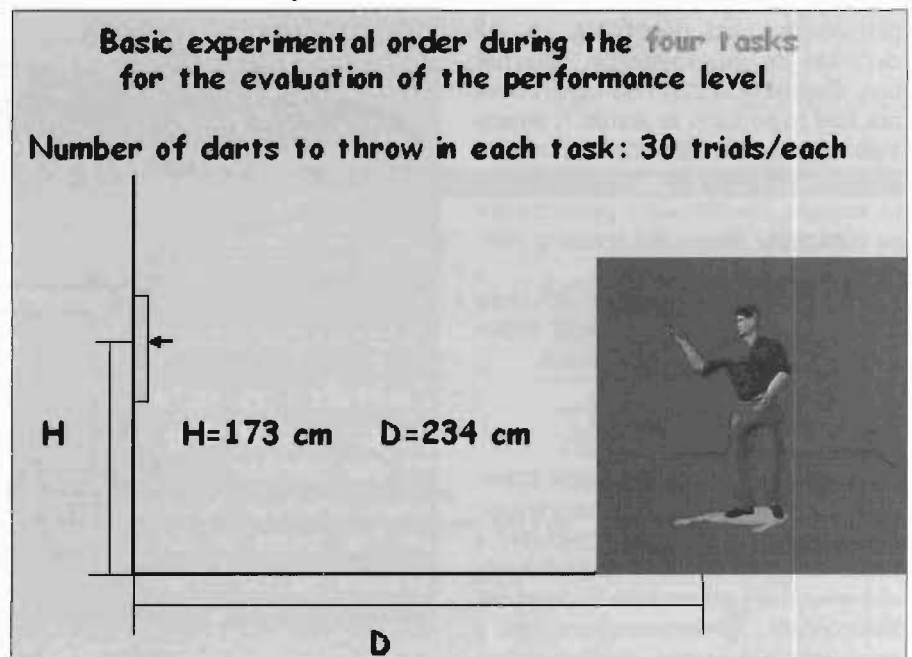


Figure 3.

Basic experimental order during the tasks

have measured the standard deviation of the throw darts. After quantifying both successful/unsuccessful ratio and standard deviation were used to analyse the differences between the expert and non-expert players in the information process. One hand this method lends us a strong support to estimate the performance level of the participants and on the basis of that separates them into different kind of learning stages according to Knapp theory. This is because this quantifying method is very sensitive using two different kinds of criteria's to rank the participants. On the other hand the two different motor controlling (Varga, M. Vass, Z. 2001) strategies can be separated and on the basis of this it can be demonstrated that at the first three stages movements controlled by generalised motor program using general parameter without prior or less experiment in the movement execution. Opposing to this at the last two stages movement controlled by motor program due to long learning process, and accumulated experiences. This motor program contains special parameters to execute the movements with minimal attention and visual information supporting only to the kinaesthetic information.

Subjects

12 undergraduate sport university students (Sommelweis University, Faculty of Physical Education and Sport Sciences) and two professional Hungarian darts player participated in

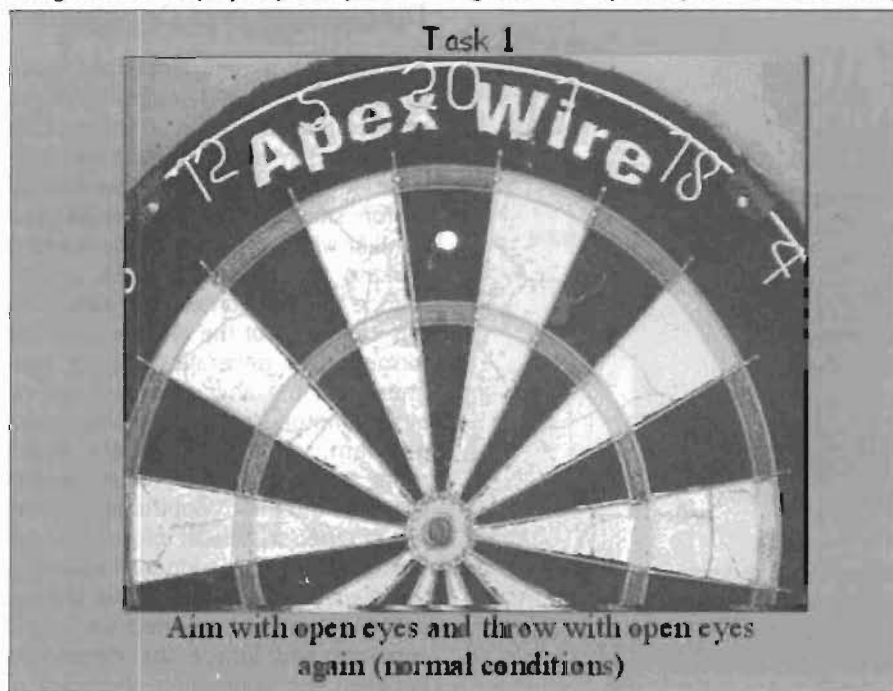


Figure 4. Task 1 where the darts must be thrown in normal condition using visual and kinaesthetic information

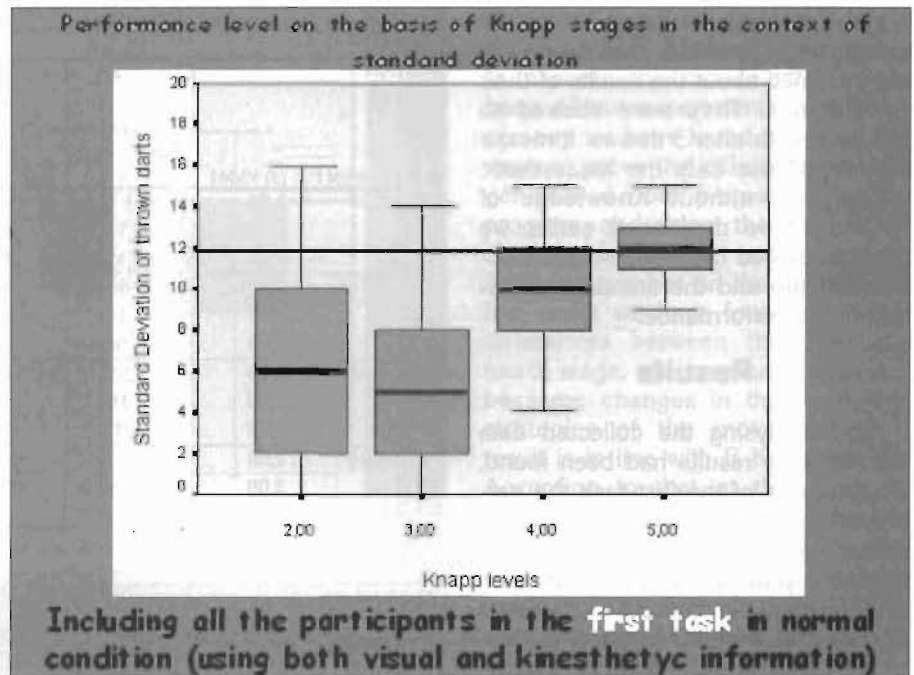


Figure 5. Performance levels on the basis of Knapp in the context of standard Deviation

this experiment. Participants were not aware of the specific purpose of the study. Their age ranged between 16 and 27 years and half of them were female.

Instruments and Procedures

This experiment is dedicated to estimate the performance (Wadman, W.J. 1979) level of the participants on the basis of earlier mentioned B. Knapp theory. For the evaluation of the level of performance 4 different tasks were given to the participants after warming

up. There are common conditions (Figure 3) in the tasks for example: participants had 30 attempts to throw in each task, the distance between the throwing line and the target were constant as well as the height of the target area and the ground. In the first task participants had to throw their darts as close as possible to the yellow marker, which were placed into the 20 area (12 cm apart from the middle of dart table) as can be seen on the picture (Figure 4). They were allowed to throw in normal conditions, which mean they were allowed to keep open their eyes during aiming and throwing to monitor their movement.

In the second task the condition during throwing were changed. It means during the throwing part the eyes had to be closed. Participants had to aim the given area with open eyes and then they had to throw the darts with closed eyes using both visual and kinaesthetic information to aim and using only kinaesthetic information during execution. After each throwing they were allowed to see the results of the performance.

In the third task participants were allowed to aim with open eyes at the beginning of the three attempts and than during the aiming and throwing phase their eyes were not allowed to keep open. About the performance or the result we instructed them in verbal way after each throw about the result of their performance. It means they had to use their kinaesthetic information plus the given verbal information to reach the best result.

In the last task they were allowed to aim at once and after that they were not informed about the results of their performance. They were allowed to see the results after 3 throws. It means they could use only the kinaesthetic information without Knowledge of Result. As we mentioned earlier we have measured the successful/unsuccessful ratio and the standard deviation of the performance.

Results

After analysing the collected data the following results had been found. On the basis of the first task the participant's proficiency were estimated. As can be seen on the figure 5 the participant's proficiency level according to Knapp in the context of standard deviation of the thrown darts is illustrated. The black line marks the target area. At the first proficiency level both the standard deviation and the distance between the mean and the target area line is so much. Shifting to the third proficiency level remarkable changes can not be observed. If we move to the last two highest proficiency stages we can see the standard deviation of the thrown darts is getting shorter or almost diminish as well the distance between the target area line and the mean line. To check the differences between these proficiency stages, One-way Anova was used with Tukey multiple comparisons (Figure 6). According to that there is no significant difference between the second

| (I) KVM1 | (J) KVM1 | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|----------|----------|-----------------------|------------|------|-------------------------|-------------|
| | | | | | Lower Bound | Upper Bound |
| 2,00 | 3,00 | ,6540 | ,3767 | ,305 | -,3137 | 1,6213 |
| | 4,00 | -3,5106* | ,4888 | ,000 | -4,7663 | -2,2549 |
| | 5,00 | -5,4329* | ,8104 | ,000 | -7,5148 | -3,3509 |
| 3,00 | 2,00 | -,6540 | ,3767 | ,305 | -1,6219 | ,3137 |
| | 4,00 | -4,1647* | ,5664 | ,000 | -5,6198 | -2,7095 |
| | 5,00 | -6,0869* | ,8595 | ,000 | -8,2949 | -3,8789 |
| 4,00 | 2,00 | 3,5106* | ,4888 | ,000 | 2,2549 | 4,7663 |
| | 3,00 | 4,1647* | ,5664 | ,000 | 2,7095 | 5,6189 |
| | 5,00 | -1,9222 | ,9141 | ,152 | -4,2707 | ,4263 |
| 5,00 | 2,00 | 5,4329* | ,8104 | ,000 | 3,3509 | 7,5148 |
| | 3,00 | 6,0869* | ,8595 | ,000 | 3,8789 | 8,2949 |
| | 4,00 | 1,9222 | ,9141 | ,152 | -,4263 | 4,2707 |

*. The mean difference is significant at the .05 level.

We have used one way Anova with Tukey multiple comparisons to check the collected data.

Figure 6. One-way Anova with Tukey multiple comparison to check the differences between the participants

and the third Knapp stages as well as there is no significant difference between the fourth and fifth Knapp stages. Now let's move to the next figure (Figure 7) where the novice player's performances are illustrated including all the four different tasks in the context of standard deviation. As we can see the distance between the target area line and the mean line is not diminished and there is no change in the standard deviation as well. Again one-way Anova were used to

check, according to that there is significant difference between the performance level and the tasks. Let's see the the same figure (Figure 8) for the professionals. What we can see here is the standard deviation of the thrown darts is not so much and the target area line and the mean line distance is only maximum 2 cm. We use One-way Anova again, according to that there is no significant difference between the performance level and the different tasks.

Discussion and Conclusion

In sum this experiment is addressed to recover the differences between expert and non-expert in information processing in order to detect the characteristic of the highly performed motor skill acquisition. To become familiar with the nature of the learning process to achieve the best performance level as humans are able to. In this case we put the emphasis on the formation of generalised motor program and the shift from this generalised motor program to the motor program, which represents much more specificity and precise control with less attention requirement. In the use of different kind of information the balance shifts to the kinaesthesia from the visual information. If this shifting process can be detected we could separate and ignore the differences between the controlling strategies of the sport movements. To do this a well differentiated motor learning theory

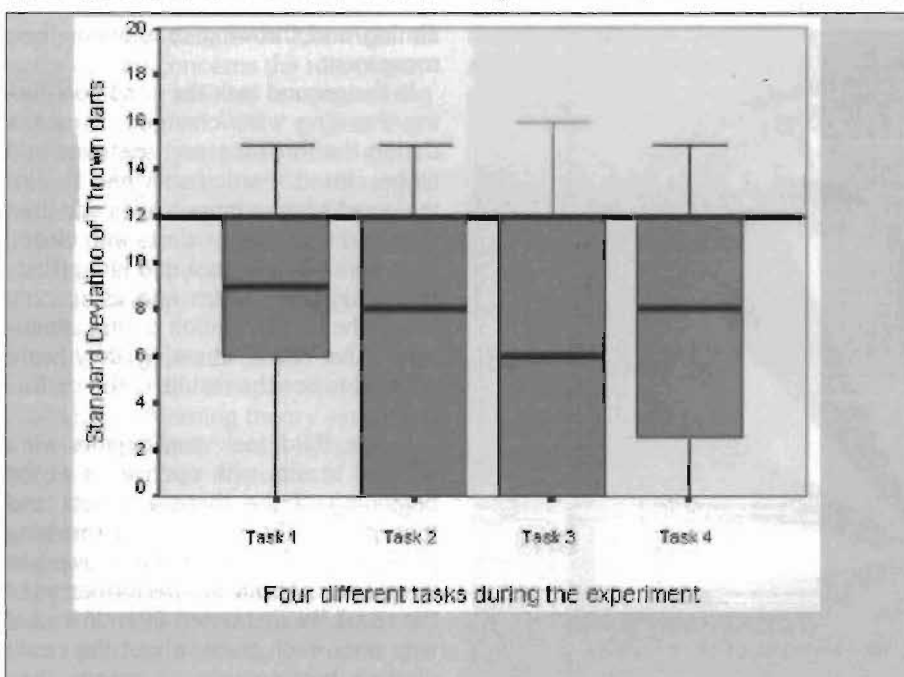


Figure 7. Performance level evaluation on the basis of four different tasks for the non-experts

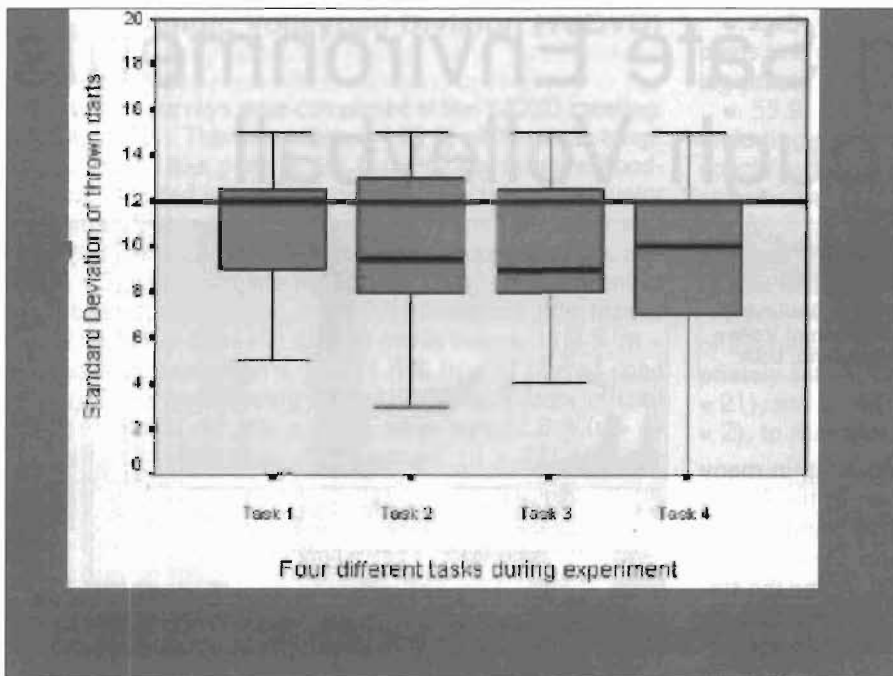


Figure 8. Performance level evaluation on the basis of four different tasks for the experts

movements controlled with motor program containing special parameters to execute the movement. On the basis of our experimental results we can say we have found two empirical ways to prove the difference between generalised motor program and motor program, and detect the main differences between expert and non-expert. As we remember on the basis of the first result we have found significant differences between the third and fourth stage, which means there must be same changes in the controlling strategies of the movement. This result is in line with B Knapp theory. According to that at this level the kinaesthetic information is connecting to the conscious control of movements. On the basis of the second result we can argue that the professional players are able to perform constantly and no decrease can be observed in their performance although the given information about their performance occurred. It means they had a special motor program controlling their movements and no need for the visual information to achieve the same best performance. This motor program can be developed only if the sportsmen take ages with practising as well as mental and physical practise to be in the best condition. So we can conclude the generalisation process can be observed only at the beginning of the learning process. At the highest level we'd rather speak about specification for the selected movement in order to achieve the best performance ever.

The Eighth International Table Tennis Federation Sports Science Congress

and

The Third World Congress of Science and Racket Sports

To be held at
National Institute of Sport, Paris, France
May 17- 19th, 2003



FIRST ANNOUNCEMENT

has to be used, which is very sensitive for the acquisition process. To achieve our aims B. Knapp 5 phase theory was used to separate the learning stages. According to that the first three stages represents the beginners. We state that at these stages movement controlled by generalised motor program according to Schmidt motor learning theory. From the third stage where the shift takes place (from the visual information to the kinaesthetic information) the movement controlling strategy must be change. We argue that at the last two stages

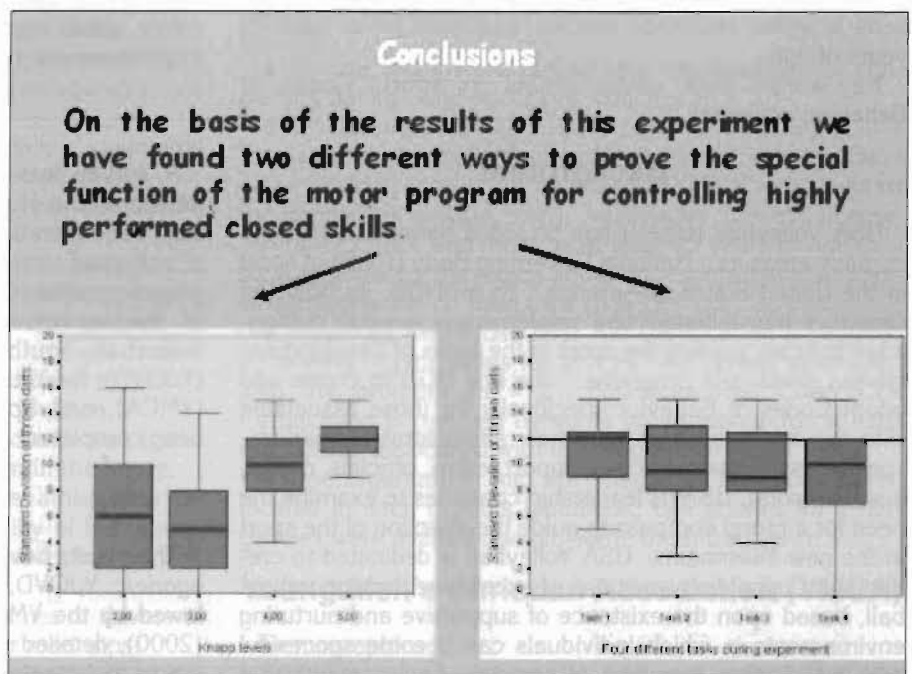


Figure 9. Conclusions



Darlene A. Kluka

Creating Safe Environments through Volleyball

Darlene A. Kluka, Laurie Dagostino*, Richard Jones, Joan Powell***, Annette Lynch******

Grambling State University of Louisiana, *USA Volleyball, **YMCA, Columbus, Ohio, ***Professional Association of Volleyball Officials, Colorado, ****Special Olympics, Maryland, USA

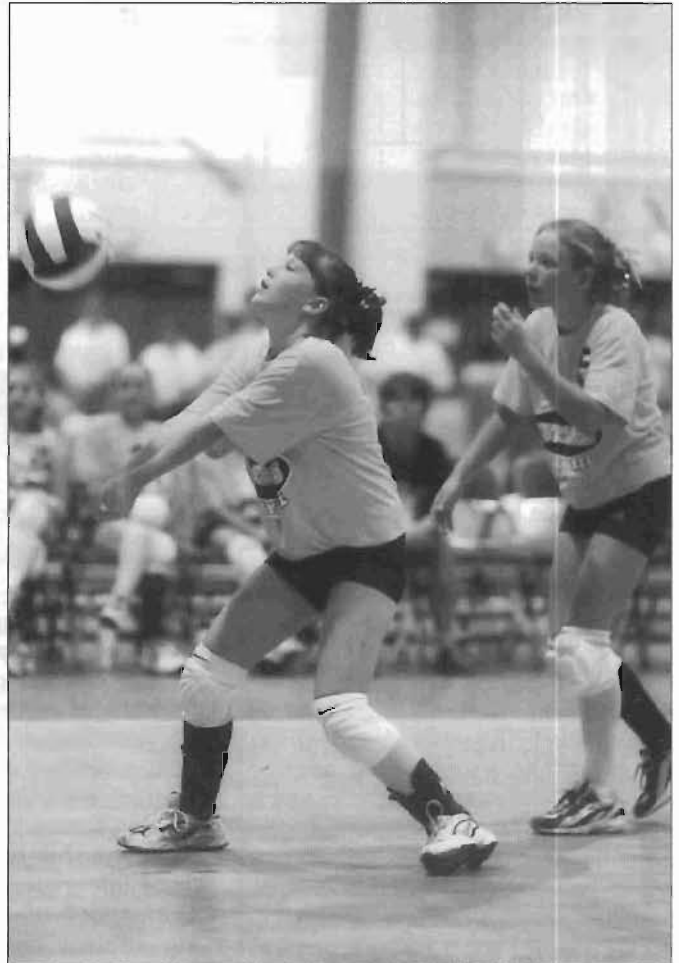
Abstract

USA Volleyball has provided national leadership in many areas as a National Governing Body of sport in the United States of America. Environments that are safe and nurturing tend to provide greater education and life-enriching experiences. This investigation sought to determine the status of environmental safety within member organizations and what the results might mean for volleyball program governance. Several organizations conduct meetings where coaches must sign a document indicating that they have been made aware of what constitutes appropriate behaviors between players and coaches. Fifty percent of the organizations require all coaches to complete registration forms with specific information about the qualifications of coaches. USAV Coaches Code of Conduct is used by 97.1 % of the organizations. Forty one percent of the organizations provide information to parents about appropriate conduct between players and coaches. Very few of the organizations (8 %) plan to implement a background check procedure on coaches; Only 29.4 % of those surveyed presently conduct official background checks on coaches. Those who are conduct them through the county/parish, the state, or the national level. American Red Cross First Aid Certification is required by several organizations for at least one person association with the program. Several organizations require parents to be responsible for player transportation on road trips, others require clean driving records, valid state driver's licenses, insurance checks, and must be at least 25 years of age.

Key-words: safe environments in sport; Codes of Behavior; volleyball

Background

USA Volleyball (USAV) has provided national leadership in many areas as a National Governing Body (NGB) of sport in the United States of America. As an NGB, its Board of Directors has initiated and implemented several cutting-edge policies, guiding the sport in the areas of developmental and grassroots programs. The first NGB to create and adopt Codes of Behavior specifically for those associated with the sport (athletes, coaches, administrators, parents, spectators, sports medicine support teams, officials, media, and sponsors), USAV's leadership continues to examine the need for a moral compass to guide the direction of the sport in the new Millennium. USA Volleyball is dedicated to creating and upholding traditions of excellence through volleyball, based upon the existence of supportive and nurturing environments in which individuals can become successful and contributing members of society. Environments that are safe and nurturing tend to provide greater education and life-enriching experiences. With this in mind, the leadership



and staff decided to determine the status of environmental safety within member organizations and what the results might mean for volleyball program governance.

Introduction

A survey was created and conducted by the Member Relations and Human Resources Division (MRHR) leadership, in cooperation with USAV staff, to determine the status of volleyball environments in grassroots and developmental programs within USAV member organizations. Final results of the survey, conducted in cooperation with USAV Volleyball Youth, Junior Olympic Volleyball Division (YJOVD), the Young Men's Christian Association of the USA (YMCA), and Special Olympics International (SOI) has been completed.

Results

The results have been divided into the following three categories: YJOVD, YMCA, SOI. YJOVD is detailed first, followed by the YMCA. Finally, SOI, summarized by Lynch (2000), detailed several of Special Olympics' existing programs that meet the needs through the creation of safe environments for those associated with Special Olympics Volleyball.

Junior Olympic Volleyball Division (YJOVD)

Demographics

Thirty-four surveys were completed at the YJOVD meeting, August, 2000. This represented 100 % of those in attendance. Ninety four percent (94.1, $n = 32$) of those responding were affiliated with club programs, which included junior programs. Within those, 66 % ($n = 21$) were affiliated with junior programs 25 % ($n = 8$) with high school programs, and 9 % ($n = 3$) with collegiate programs. Thirty eight percent ($n = 13$) offered boys' teams, while 97.1 % offered girls' teams. Nearly 21 % (20.6, $n = 7$) offered men's teams, 11.8 % ($n = 4$) offered women's teams, and 11.8 % ($n = 4$) offered coed teams. The overwhelming majority of respondents offered indoor programs (97.1 %, $n = 33$), while only 11.8 % ($n = 4$) offered beach programs. Fifty percent ($n = 17$) of those responding were listed as head coach/program administrator, 35.2 % ($n = 12$) as program administrator only, 8.8 % ($n = 3$) as head coach only, and 5.9 % ($n = 2$) as assistant coach ($n = 2$) only. Women represented 38.2 % ($n = 13$) of the respondents, while men represented 61.8 % ($n = 21$). Women's ages ranged from 33 to 62, while men's ages ranged from 26 to 65. The overwhelming majority of organizations provided programs in urban (50 %, $n = 17$) and suburban (58.8 %, $n = 20$) areas of the country. Of those responding, 32.4 % ($n = 11$) provided programs for rural areas.

Summary

Based upon the contributions of YJOVD respondents, the following results have been determined:

- 50 % of the organizations require all coaches to complete registration forms with specific information about the qualifications of coaches;
- 97.1 % of the organizations presently use the USAV Coaches Code of Conduct;
- 64.7 % of the organizations presently use the USAV Codes of Behavior for Athletes, Officials, Sports Medicine Support Teams, Parents, Administrators, and Sponsors;
- 41.2 % of the organizations provide printed materials outlining appropriate relationship behavior between players and coaches;
- 50 % of the organizations provide information to parents about appropriate conduct by players and coaches;
- 61.8 % of the organizations have grievance procedures relative to inappropriate conduct of those involved with their organizations;
- 38.2 % of the organizations have officially encountered player/coach relationships that were suspect;
- 29.4 % of the organizations presently conduct official background checks on coaches;
 - Of those presently conducting official background checks on coaches, 14.7 % conduct them by county (parish); 20.6 % by state; 14.7 % national in scope;
 - The cost of each background check ranges from a service, provided by the sheriff's department, to \$25.00 USD. These costs vary by geographic location;
- 8 % of the organizations not presently conducting background checks plan to implement a system in the future;
- 67.6 % of the organizations require athletes to be informed of the inherent dangers (possibility of injury, etc. because of participation in volleyball) in volleyball participation;
- 2.9 % of the organizations require coaches or drivers of vehicles to possess chauffeur's licenses for road trips;
- 29.4 % of the organizations require a member of the coaching staff to be knowledgeable in first aid and emergency procedures;

- 25.3 % of the organizations have crisis plans (action plans in emergency situations) in place in emergencies during practice and at matches/tournaments;

- 55.9 % of the organizations carry medical history, including emergency telephone numbers for each coach/support staff that is available at practice and matches/tournaments;

- 64.7 % of the organizations use chaperones other than coaches to supervise players off the court when attending tournaments and away matches;

- When organizations host tournaments/matches, the title of the person responsible for seeing that the court is appropriately safe in its set up varies from tournament director ($n = 21$), site coordinator ($n = 3$), emergency services \bar{n} 911 ($n = 2$), to manager ($n = 1$).

Additionally, the following information was also provided through narrative:

- 94.1 % of the organizations require the signing of USAV Coaches Code of Conduct document by coaches;

- USAV Impact Manual printed material is disseminated ($n = 5$), outlining appropriate relationship behavior between players and coaches; clubs hold coaches' meetings to discuss the issue ($n = 4$); few clubs have published their own guidelines on the issue ($n = 2$); few clubs have developed a Parental Code of Conduct so that parents are aware of signs ($n = 2$); few organizations have information posted on their websites ($n = 2$);

- Several organizations ($n = 12$) conduct meetings where coaches must sign a document indicating that they have been made aware of what constitutes appropriate behaviors between players and coaches;

- Several organizations have grievance forms for completion relative to inappropriate conduct of those involved with the organization ($n = 4$); few organizations have placed the document on their websites ($n = 2$) as well as in their Member Handbooks ($n = 2$); due process forms are also available through the region ($n = 8$);

- If no official background check was conducted, few organizations informally asked friends within law enforcement if anything was known about individuals ($n = 2$); references of potential coaches are checked by telephone calls ($n = 2$);

- Several regions are researching the feasibility of conducting background checks on coaches ($n = 5$);

- Several organizations require parents to be responsible for player transportation on road trips ($n = 8$); others require clean driving records (no record of DWI/DUI, prosecutions for dangerous driving, etc.), valid state driver's license. Insurance check and must be at least 25 years of age ($n = 8$); disclaimer by the region about no responsibility for player transportation on road trips ($n = 1$);

- American Red Cross First Aid Certification is required by several organizations for at least one person associated with the program ($n = 8$); American Red Cross CPR Certification is required by some organizations for at least one person associated with the program ($n = 3$);

- One organization had an emergency situations sheet, located in each coach's handbook; cell phones for emergencies were available within some organizations ($n = 3$).

Young Men's Christian Association (YMCA)

Demographics

Eighty surveys were completed by mail or fax. This represented 40 % of those surveyed ($N = 200$). Within those, 50 % ($n = 40$) was affiliated with youth programs. Fifty per-

cent offered men and women's recreation league teams ($n = 40$). All respondents offered indoor programs (100 %, $n = 80$). Ninety five percent ($n = 76$) of those responding served as Program Administrators of the YMCA; 5 % ($n = 4$) served as coach/assistant coaches. Women represented 50 % ($n = 40$) of the respondents. Women's ages ranged from 25 to 43, while men's ages ranged from 26 to 46. The overwhelming majority of YMCAs responding were located in rural (54 %, $n = 43$) and suburban (31 %, $n = 25$) areas of the country. Of those responding, 15 % ($n = 12$) were located in urban areas.

Summary

Based upon the contributions of YMCA respondents, the following results have been determined:

- 32.5 % of the organizations ($n = 26$) required all coaches to complete registration forms with specific information about the qualifications of coaches;
- 5 % of the organizations ($n = 4$) presently use the USAV Coaches Code of Conduct;
- 12.5 % of the organizations ($n = 10$) presently use the USAV Codes of Behavior for Athletes, Officials, Sports Medicine Support Teams, Parents, Administrators, and Sponsors;
- 50 % of the organizations ($n = 40$) provide printed materials outlining appropriate relationship behavior between players and coaches;
- 63 % of the organizations ($n = 50$) conduct meetings where appropriate player/coach relationships were discussed;
- 68 % of the organizations ($n = 54$) provide information to parents about appropriate conduct by players and coaches;
- 54 % of the organizations ($n = 43$) have grievance procedures relative to inappropriate conduct of those involved with their organizations;
- 5 % of the organizations ($n = 4$) have officially encountered player/coach relationships that were suspect;
- 54 % of the organizations ($n = 43$) presently conduct official background checks on coaches (primarily upon hiring of YMCA staff);
 - Of those presently conducting official background checks on coaches, 50 % conduct them by county (parish); 92 % by state; 9 % are national in scope;
 - The cost of each background check ranges from a service, provided by the sheriff's department, to \$32.00 USD. These costs vary by geographic location;
- 5 % of the organizations ($n = 4$) NOT presently conducting background checks plan to implement a system in the future;
- 56 % of the organizations ($n = 45$) require athletes to be informed of the inherent dangers (possibility of injury) in volleyball participation;
- 3 % of the organizations ($n = 2$) require coaches or drivers of vehicles to possess chauffeur's (CDL) for road trips. Most organizations do not provide competition that requires road trips;
- 18 % of the organizations ($n = 14$) require a member of the coaching staff to be knowledgeable in first aid and emergency procedures;
- 50 % of the organizations ($n = 40$) have crisis plans (procedures) in place for emergencies during practice and at matches/tournaments;
- 58 % of the organizations ($n = 46$) carry medical history and emergency telephone numbers for each player that is available at practice and matches/tournaments;

- 56 % of the organizations ($n = 45$) carry permission to transport and begin medical procedures for each player that is available at practice and matches/tournaments;

- 39 % of the organizations ($n = 31$) carry medical history, including emergency telephone numbers for each coach/support staff that is available at practice and matches/tournaments;

- 100 % of the organizations ($n = 2$) use chaperones other than coaches to supervise players off the court when attending tournaments and away matches. This figure is somewhat misleading, as only 3 % ($n = 2$) reported away matches;

- When organizations host tournaments/matches, the title of the person responsible for seeing that the court is appropriately safe it is set up varies from volleyball coordinator, youth volleyball director, coaches, YMCA staff member(s), or sports coordinator;

- When organizations host tournaments/matches, the title of the person responsible for crowd/spectator control varies from volleyball coordinator, youth volleyball director, coaches, YMCA staff member(s), or sports coordinator;

- When organizations host tournaments/matches, the title of the person responsible for injuries services varies from volleyball coordinator, youth volleyball director, coaches, YMCA staff member(s), or sports coordinator. Only 1 % reported using Emergency Medical Treatment services.

Additionally, the following information was also provided through narrative:

- Several organizations do not provide information to parents about what is meant by appropriate conduct of players and coaches (50 %; $n = 40$); several organizations have no method of knowing whether or not parents have been informed (50 %; $n = 40$); many organizations inform parents by parental meetings (28.75 %; $n = 23$);

- American Red Cross CPR and First Aid Certifications are required by relatively few organizations for at least one person associated with the program (22.5 %; $n = 18$). This number escalates when general YMCA staff members are included (90 %; $n = 72$);

- Many YMCAs (57.5 %; $n = 46$) are presently utilizing Child Abuse Prevention Training programs, the YMCA Super Sport Book, YMCA Youth Sports Coaches Handbook, YMCA Character Development programs, and YMCA Parents Code of Ethics to enhance efforts in creating safe environments through YMCA volleyball programs;

- Several YMCAs (82.5 %; $n = 66$) have developed their own templates involving parental information; waiver/release and indemnity agreements; health history, including dentist, optometrist/ophthalmologist, physician, medical insurance; names of authorized persons to pick up children from volleyball functions; player policy and practice agreements; termination from program; Code of Conduct which includes signature and an understanding that any violation of Code may result in termination.

Special Olympics International (SOI)

Special Olympics International has provided detailed commentary regarding what has been included in the creation of safe environments for Special Olympics athletes. Below is a summary:

Coaches are required to complete an application form with specific information about their qualifications as coaches. The following information is provided:

- Name, address, phone/fax numbers, email address
- Employer, employer's address, phone/fax numbers, email address

- Sex, social security number, state, and date of expiration
- Emergency contact information
- Information for guardian if applicant is 17 years of younger
 - Volunteer interest (areas of interest: coaching, officiating, office support, etc.)
 - Sports interest
 - Special skills (commercial drivers, computer, CPR, etc.)
 - Availability during week
 - Listing of previous volunteer affiliations
 - Five questions dealing with use of illegal drugs; conviction of criminal offense; charges of neglect, abuse, or assault; suspension or revocation of driver's license; criminal background check
 - Listing of 2 non-family references
 - Signature, having read and answered questions accurately

Special Olympics provides printed materials outlining appropriate relationship behavior between players and coaches.

- Printed materials and videos are for athletes and volunteers. The information is included under Protective Behaviors, Resource Kit, which includes Guidebook and training materials (Participant Guide, Instructor Guide, and video)

Special Olympics provides coaches training where appropriate player/coach relationships are discussed.

- Appropriate relationships and contact are discussed in every coaches training session and/or course. It is covered in more depth in Protective Behaviors Workshops. Many of the United States programs have their coaches and volunteers sign a code of conduct, which addresses appropriate relationships and contact, policy on drugs, alcohol, tobacco, etc.

Training for coaches includes the following:

- All accredited programs must conduct approved coach education in accordance with the Official Special Olympics General Rules. Programs have three options:
 - Implementing the Special Olympics Coach Education System;
 - Submitting documentation verifying that Special Olympics Coach Education System Standards and Competencies are achieved within their own system; OR
 - Be authorized by a Special Olympics Program representative verifying such experiences and coaching competencies
- Coaches must achieve the beginning certification level within four years upon entering Special Olympics to become a coach. In order to maintain and/or upgrade coach certification, a coach continues approved coach education. Each coach upgrades knowledge and experience at least once every four years.

Special Olympics also provides information to parents about appropriate conduct by players and coaches.

- Information is provided in program newsletters, which goes out to families, coaches, athletes, and volunteers, and at training sessions for family members

There is also a grievance procedure relative to inappropriate conduct of those involved with Special Olympics.

- Each United States program has a grievance procedure

that follows due process within each state. That procedure is posted, circulated, and provided to all athletes, coaches, family members, and volunteers.

Special Olympics programs, at state levels, also have formalized relationships with the law enforcement community. Official background checks are conducted on coaches through the submission of names to local law enforcement members, who conduct background checks through their database. These background checks are conducted at the state and local levels. Cost is nominal or free.

All Special Olympics programs require pre-participation physical examinations as well as the signing of a waiver/release form before athletes are permitted to participate in programs.

A Chauffeur's license (CDL) is required for road trips if a bus is driven. If it is a small van or car, no CDL is required. The driver must possess a valid state driver's license, and will not have been convicted of driving under the influence of alcohol or drugs.

Each Special Olympics Program has developed its own emergency action plan template. Each individual program customized it, and provides it to their coaches during coaches training and prior to each season.

When Special Olympics hosts tournaments/matches, there is a sport-specific competition director on site. The person responsible for crowd control is the venue director. The person responsible for services when injuries occur is the medical support staff or emergency medical staff on site. There is at least one coach or chaperone for every four athletes. They are parents or volunteers who have been working with the athletes. Many are school or agency professionals who are familiar with special needs. The head coach goes over the plan for supervision and dispensing of medication (if necessary).

Samples of Special Olympics Maryland Codes of Conduct, Codes of Conduct infractions, and Codes of Conduct Committees are available through Annette Lynch at alynch@somd.org.

Recommendations for Action

Based upon the results detailed above, the following recommendations have been made for consideration to the USA Volleyball Board of Directors for adoption, and staff/Divisional leadership for implementation:

- It appears that more than half of the organizations surveyed require some information about coaches' qualifications. Development of a sample template detailing appropriate information for registration as a coach could provide meaningful assistance in coach selection. The development of the template could be completed and distributed by the USAV Coaching Education staff via email. SOI can provide a sample template.

- Over two-thirds of the organizations presently use the USAV Codes of Behavior. The YMCA of the USA and Special Olympics have developed their own, meeting their constituents' needs and missions of their respective organizations. Asking all YJOVD programs and other member organizations to republish the USAV Codes of Behavior, located on the USAV website or in the USAV 2000 Guide, could facilitate their use.

- Less than half of the organizations surveyed provided printed material outlining appropriate relationship behavior between players and coaches. Because 40.6 % of those surveyed officially encountered player/coach relationships that

were suspect, this issue shows importance. All coaching education materials (IMPACT, CAP Levels I, II, and III) and USAV newsletters need to reflect this by providing information on the topic. The incorporation of seminars, workshops, or sessions on the topic would be appropriate within coaching education clinics or seminars. SOI has already devised a Protective Behaviors Resource Kit (Participant Guide, Instructor Guide, and video) that is available as a model.

- Less than half of the organizations provided information to parents about appropriate conduct by players and coaches. In developmental programs, integrating parental involvement seems paramount to the discussion. The development of a USAV Parents' Handbook: A Guide to Safe Environments through Volleyball Participation (or something similar) that could be utilized by member organizations would provide additional meaning and excellent public relations. This project might be selected as one completed by the MRHR Division, in cooperation with YJOVD.

- More than two-thirds of the organizations require athletes to be informed of the inherent dangers in volleyball participation. The development of a policy statement involving the inherent dangers could be created by USAV Sports Medicine and Performance Commission and distributed through various volleyball publications as well as the USAV website.

- Less than one-third of the organizations require a member of the coaching staff to be knowledgeable in first aid and emergency procedures. This seems to place many participants at risk of emergency assistance. The American Red Cross has developed a Sports First Aid certification program as well as CPR training program. USAV and the American Red Cross might be able to enter into some type of cooperative agreement in certification of coaches in first aid, emergency procedures, and CPR that could be incorporated into coaching education programs.

- Slightly more than one-third of the organizations have crisis plans in place in emergencies during practice and at matches/tournaments. A crisis plan template could be developed by members of the USAV SMPC, in cooperation with USAV Coaching Education staff that could be distributed in newsletters, handbooks, coaching education materials, and on the website.

- More than half of the organizations carry medical history, including emergency telephone numbers for coaches and support staff. It is imperative for information to be available on coaches and support staff as well. Reminders could be placed in all publications and on the website to incorporate this information into already existing documentation. Over 90 % of the organizations already provide this information on players; this would be a simple and important piece of information that could save the lives of coaches and support staff.

- Over two-thirds of the organizations use chaperones other than coaches to supervise players off the court when attending away events. Sample templates of what is required and expected as a chaperone could be developed by the MRHR Division. SOI and YMCA, for example, already have detailed lists available. The list could be disseminated through USAV publications, coaching education materials, and the USAV website.

- During tournaments, Tournament Directors are generally those responsible for the oversight of safe environments. The USAV Board of Directors may want to recommend that services of certified athletic trainers are available at tournaments. The Health South model is already being used by

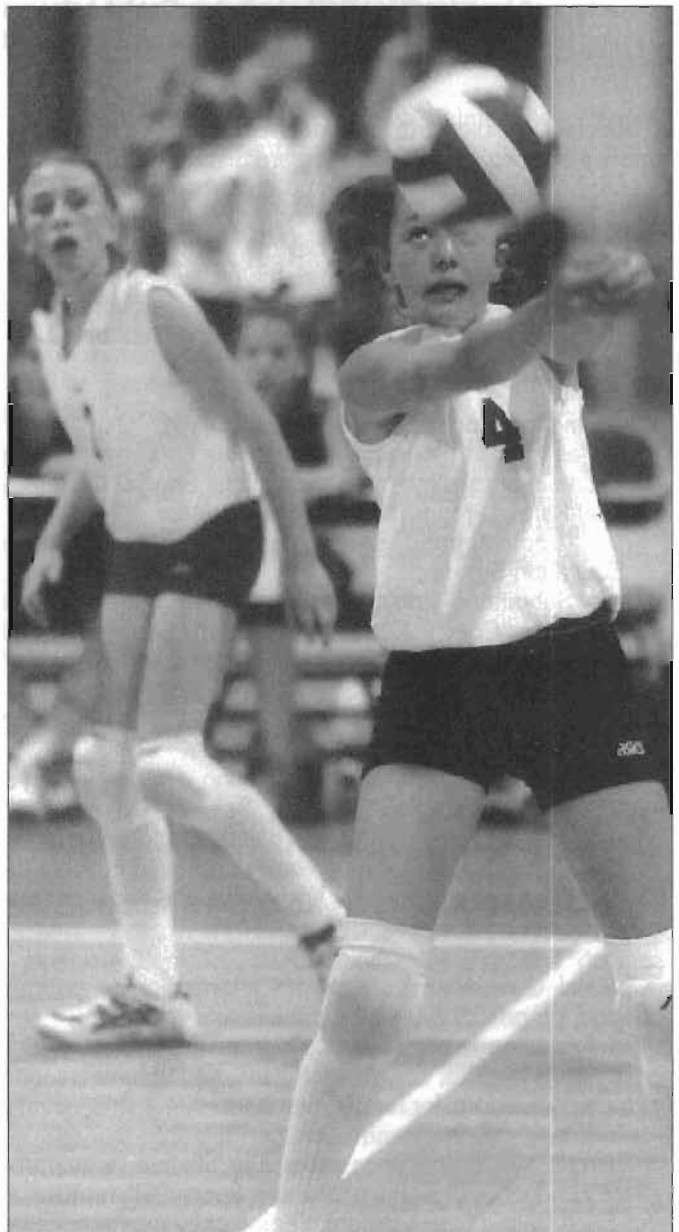
USA Volleyball at national championships could provide a template for such a recommendation.

- The development of emergency situation scenarios, located in coaches' handbooks, could provide opportunities for mock experiences in emergency situations. Incorporating the scenario-approach into coaching education materials, coaching seminars, and websites could facilitate decision-making development.

- The development of appropriate conduct scenarios, located in coaches' handbooks, could provide opportunities for mock experiences in value-challenging situations. The YMCA has already created some scenarios through their character-building program that might serve as the basis for templates.

Acknowledgements

The investigators wish to thank the following people for their contributions and support in this investigation: Kerry Klostermann, Ph. D., USAV Executive Director; Albert Monaco, USAV President; Rebecca Howard, USAV Past President; Karen Johnson, Ph. D., USAV Secretary; Peter Dunn, Vice President, USAV MRHR Division; Cynthia Doyle, USAV Board of Directors, NFSHSA.



Health-Enhancing Physical Activity; from Research Evidence to Promotion

Pekka Oja,

UKK Institute, Tampere

(This paper is based on the presentation given by the author in the 7th annual congress of the European College of Sport Science held in Athens, July 24-27, 2002)

Abstract

Systematic and critical assessment of the research evidence on health benefits of physical activity has drawn increasing attention to physical activity as a health promoting behaviour. The research evidence suggests that physical inactivity increases the risk of many of the most common non-communicable diseases significantly. Furthermore, better understanding of the dose-response relationships between physical activity and health outcomes warrants a broad population approach in promotional measures. Together with the high prevalence of insufficient activity, nearly half of the populations of EU countries, the potential of physical activity for public health is considered very substantial. The new evidence has already led to many initiatives in Europe and globally to place health-enhancing physical activity (HEPA) in the national health agenda. Currently most EU countries have national HEPA programs, strategies or policies and this movement is spreading into other parts of the world as well. The research community's continuing role is to provide the supportive evidence in order to make physical activity an integral part of public health policies.

Key-words: physical activity, health benefits, public health, health promotion, policy initiatives

Introduction

The health relations of sport, exercise and physical activity have been of the interest of the sport and health research communities for decades. Classical epidemiological works such as those by Jerry Morris and Ralph Paffenbarger have suggested a strong relationship between physical activity and health. However, only in the late

1980's and 1990's the continuingly accumulating evidence became strong enough for physical activity to be considered seriously as a public health issue. Systematic and critical assessment of the research evidence and the subsequent public health recommendations and policy initiatives have brought physical activity into the health agenda of many countries in Europe and globally.

Health benefits of physical activity

In 1996 the Surgeon General of the United States issued an important document "Physical Activity and Health" (US Department of Health and Human Services 1996) whereby it was stated that:

Promotion of physical activity is important in the whole population because it

- benefits growth and development in children and youth
- prevents many diseases in adults
- helps maintaining functional capacity in elderly
- supports independent life-style in ageing people

The most recent critical review of the research evidence comes from a consensus symposium

"Dose-response of physical activity and health: An evidence-based symposium" (MSSE 33(6), Suppl. 2001). The symposium concluded that regular physical activity is associated with

- total mortality
- cardiovascular mortality and morbidity
- coronary heart disease
- obesity
- type II diabetes
- colon cancer
- osteoporosis
- improved metabolic control in type

II diabetes

- function and independence among elderly

- depression

■ in addition, physical activity has beneficial effects on several risk factors for cardiovascular diseases by

- reducing blood pressure

- improving blood lipid profile

- improving the blood coagulation and haemostatic factors

Based on the current evidence it is estimated (U.S. Department of Health and Human Services 1996, Medicine and Science in Sports & Exercise 2001) that physically inactive middle-aged and elderly people have substantially higher risk of several common non-communicable disease as compared to moderately and highly active people:

- coronary heart disease: 1.5-2 times higher risk

- ischemic stroke: up to 2 times higher risk

- diabetes (NIDDM): 20-60 % higher risk

- obesity: to be or to become 2 times higher risk

- hypertension: 30 % higher risk

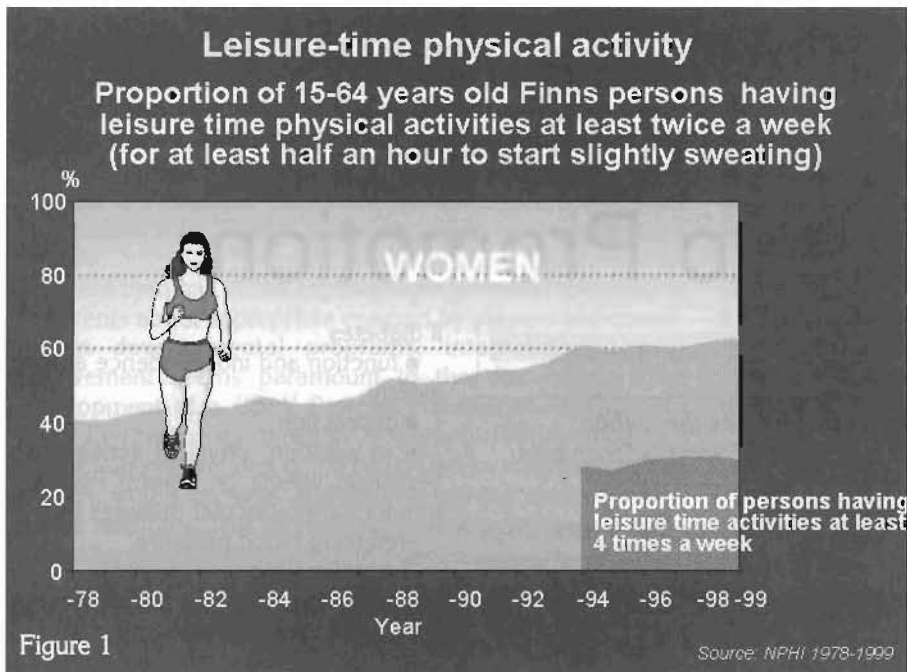
- colon cancer: 40-50 % higher risk

- breast cancer: 30 % higher risk

- osteoporotic fractures: 30-50 % higher risk

Characteristics of health-enhancing physical activity

The recent research evidence on the health benefits of physical activity has also provided new understanding of the dose-response characteristics of activity and health. While the older recommendations (American College of Sports Medicine 1985) emphasised vigorous uninterrupted aerobic exercise for fitness benefits, the newer evidence shows that health benefits are also accrued through moderate-intensity intermittent daily activity. Thus the U.S. Surgeon General report (U.S. Department of Health and Human Services 1996) recommends that "All children and adults should accumulate



30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week."

This new concept of health-enhancing physical activity is inclusive for many lifestyle physical activities not only during leisure time but also at occupational and domestic work and in transportation. This lowers the threshold for inactive people to become active and extends the potential for increased activity and the concomitant health benefits to wider population segments beyond those interested and capable of vigorous exercise and sports.

Physical activity patterns in Europe

Many European countries assess population physical activity levels from time to time, but only a few conduct regular monitoring. The National Public Health Institute of Finland has done this since 1978 as part of annual health-related behaviour survey of the adult population (National Public Health Institute 2000). The level of leisure-time physical activity (at least twice a week, 30 min each time with slight sweating) has increased steadily over the 20-year period from about 40 % to 60 % among both men and women with apparent levelling off in the latter part of 1990's (Figure 1 and 2.). However, during the same time period work commuting walking and cycling decreased steadily among both men (from 35 % to 25 %) and women (from 40 % to 35 %), thus suggesting an interesting paradox: people seem to exercise more, but they are less physi-

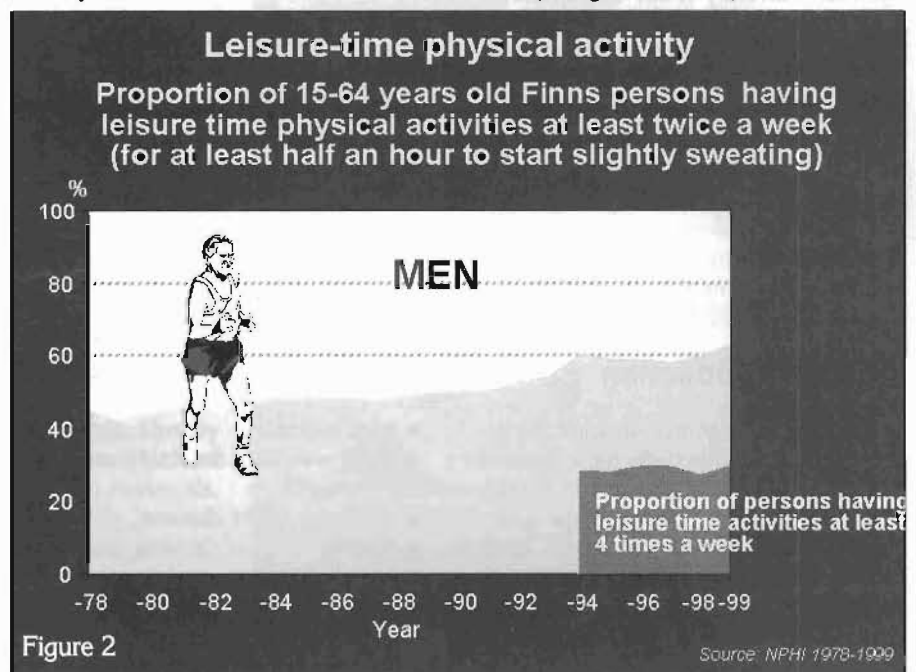
cally active in everyday life. Putting these together, it has been estimated that more than half of the Finnish adult population is currently insufficiently active for full health benefits.

An earlier attempt to make cross-national comparisons of HEPA compared the data of national physical activity surveys from four countries: England, Canada, Sweden and Finland (Oja 1995). All countries used their own assessment methodology and different cut-off points for sufficient activity and the surveys yielded widely varying figures for active population percentage (29-48 %) likely with little relevance to real cross-country differences.

A more recent study, the Pan Europe Survey of Consumer Attitudes to

Physical Activity, Body Weight and Health (Vaz de Almeida et al. 1999), utilised standard methodology across 15 European Union countries. While none of the derived outcome measures were designed specifically for HEPA assessment the results provide comparable activity patterns across these European countries. By using at least 3.5 h per week leisure-time physical activity as the cut-off point, 57 % of the populations, on the average, were insufficiently active for health benefits, but the percentages varied widely from 32 % to 83 % (Figure 3). In the pooled European data women were found to participate less and for shorter periods than men. The proportion of older people participating for more than 3.5 hours decreased with increasing age while people with higher education level were more active than those with lower education levels.

Differences in assessment methodology and conceptual inconsistencies make it difficult to assess reliably the true prevalence and the cross-country differences of HEPA. This problem was highlighted in a survey of national health surveys conducted by WHO/Euro. While 32 physical activity questionnaires from 29 countries were identified, none of them utilised the new concept of HEPA, and only two countries, Lithuania and Latvia, used identical questionnaires. Thus, there is an urgent need to design and implement assessment methodology specific to HEPA. This is now taking place as a new assessment method, the International Physical Activity Questionnaire (IPAQ), has been developed and evaluated (Craig et al. 2002).



Insufficient activity in EU countries

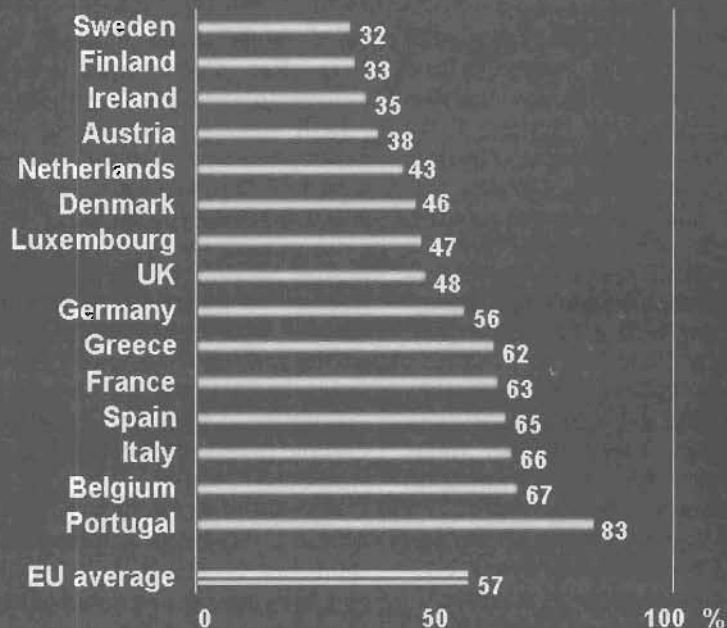


Figure 3

Vaz de Almeida et al. 1999

Policy initiatives for HEPA promotion

The supportive scientific evidence of the public health benefits of physical activity and the high prevalence of physical inactivity has generated policy initiatives for the promotion of HEPA globally (WHO 1997) and in many European countries. The European Network for the Promotion of Health-Enhancing Physical Activity was established in 1996 as one of seven European Union Health Promotion Networks (European Commission, Directorate General V, 1996). In addition to the 15 EU member states, the network also encompassed Estonia, Slovenia, Iceland, Israel, Norway and Switzerland. The network was funded by EU during the years 1996-2001 where-after it has functioned as an informal forum among the interested parties and individuals.

The Network's main function was to facilitate national HEPA policy and strategy development. The Network has published strategic guidelines for HEPA promotion (European Commission, Directorate General V, 1996), Guidelines for Health-Enhancing Physical Activity Promotion Programmes (Foster 2000), Strategic Directions for the Promotion of Transport Walking and Cycling (Oja & Vuori 2000), and Guidelines for the Development of National HEPA Policies (UKK Institute 2002). (All material is available from the UKK Institute, contact eija.savolainen@uta.fi)

Presumably at least partly as a result

of the work of the European HEPA Network many HEPA initiatives have started in Europe. The European initiatives include:

Austria

- many regional programmes and activities by Austrian Sports Federation and partners

Belgium

- national HEPA position statement and recommendations published
- Policy Research Centre for Physical Activity established in the Flemish community

Denmark

- national Forum for Physical Activity created by Minister of Health
- development a national plan to promote HEPA in progress

England

- a new national physical activity strategy in preparation by Department of Health
- National Quality Assurance Framework for Exercise Referral Systems launched by Secretary of State for Health

Finland

- second 5-year phase of national HEPA promotion program "Fit for Life" in progress
- recommendations for the local HEPA promotion issued 2000
- national HEPA strategy issued by Ministry of Health in 2001 and a subsequent Cabinet Statement in 2002

France

- action plan to develop national policy by French Federation for Physical Activity and Health in collaboration with other sports organisations in progress

Iceland

- HEPA promotion included in National Health Plan

Ireland

- physical activity included in National Health Strategy

The Netherlands

- national "Netherlands on the Move" HEPA program continues

Northern Ireland

- national HEPA strategy issued in 1998

- national campaign "Get a Life Get Active" continues

Norway

- HEPA integrated into National Council on Nutrition and Physical Activity

- national recommendations for physical activity and health issued by the Council

Slovenia

- preparation of national HEPA strategy in progress

- international HEPA conference in Radenci in 2002

Spain

- development of national HEPA strategy in progress

- Ministry of Health preparing physical activity recommendations for youth

Sweden

- year 2001 a national physical activity year

- national programme "Sweden on the Move" in progress

Globally the World Health Organisation has been interested in physical activity for a long time. In 1997 physical activity was included formally on its agenda by the establishment of the Active Living Initiative (WHO 1997). Its main objectives were HEPA advocacy, facilitation of national and community HEPA policies, programs and networks, and fostering dissemination of knowledge. Currently physical activity is an integral part of WHO's disease prevention and health promotion activities. This was highlighted recently on the occasion of the World Health Day 2002, which was dedicated to physical activity and health. Furthermore World Health Assembly 2002 commissioned the preparation of a global strategy for "Diet, Physical Activity and Health". It will include strengthening of the evidence base, promotion of advocacy and training, and collaboration with member states and regional networks for the promotion of appropriate programs and national strategies.

A very successful Brazilian HEPA program "Agita Sao Paulo" has stimulated further HEPA initiatives in the Americas and has led to the establish

ment the "Physical Activity Network of the Americas" (PANA) in 2000.

Concluding remark

The promotion of health-enhancing physical activity has taken long strides during the past decades and has become accepted increasingly a significant health promoting activity. This rapid and effective "new" emergence of health-related physical activity has been possible through comprehensive evidence assessment, strong support of influential professional and civic organisations and systematic facilitation of policy development. The outlook for the promotion of health-enhancing physical activity seems bright. The role of the research community is to support this momentum towards the eventual goal, health-enhancing physical activity being an integral part of public health policies.

References

American College of Sports Medicine. Guidelines for graded exercise testing and exercise prescription. 3rd ed. Philadelphia: Lea & Fabiger, 1985.

Cora L Craig, Alison L Marshall, Michael Sjöström, Adrian E Bauman, Michael L Booth, Barbara E Ainsworth, Michael Pratt, Ulf Ekelund, Agneta Yngve, James F Sallis Pekka Oja, and the IPAQ Consensus group and the IPAQ Reliability and Validity Study Group :The International Physical Activity Questionnaire (IPAQ): 12-country reliability and validity. Submitted for publication.

European Commission, Directorate General V. Promotion of health-enhancing physical activity. Tampere: UKK Institute, 1996.

Foster C. Guidelines for health-enhancing physical activity promotion programmes. Oxford: British Heart Foundation Health Promotion Research Group, 2000.

Medicine and Science in Sports and Exercise. Dose-response issues concerning physical activity and health: An evidence-based symposium. Supplement to 33(6), 2001.

National Public Health Institute. Health behaviour and health among the Finnish adult population, Spring 2000. Helsinki, 2000.

Oja P, Vuori I. Promotion of transport walking and cycling in Europe:

Strategy directions. Tampere: UKK Institute, 2000.

Oja P. Descriptive epidemiology of health-related physical activity and fitness. Res Quarterly Exerc Sport 1995;66(4):303-312.

UKK Institute. Guidelines for the development of national HEPA policies. UKK Institute 2002. (available in internet: www.ukkinstituutti.fi)

US Department of Health and Human Services. Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion, 1996.

Vaz de Almeida DA, Graca P,m Afonso C, D'Amicis A, Lappalainen R, Damkjaer S. Physical activity levels and body weight in a nationally representative sample in the European Union. Public Health Nutr 1999;2 (1a):105-113.

World Health Organisation. Active living. Report of the Informal Meeting of "Active Living: Physical Activity for Health". WHO/HQ, 27-28 February 1997. WHO, HPR/97.8, 1997.

Major International Conferences 2003-2004

The Eighth International Table Tennis Federation Sports Science Congress and The Third World Congress of Science and Racket Sports

To be held at National Institute of Sport, Paris, France May 17-19th, 2003

congress website: www.ittf.com

website: www.wcss.org.uk

8th Annual Congress European College of Sport Science

Salzburg, Austria. July 9-12, 2003.

Deadline for abstract submission: February 15, 2003

E-mail: ecss2003@sbg.ac.at - www.ecss2003.at

ISAPA Conference: Inclusion, Coexistence, Human Value for All through Adapted Physical Activity 14th International Symposium Adapted Physical Activity

August 4-7, 2003, Seoul, Korea

Contact: Human movement and Performance

College of Ewha Womans University

<http://home.ewha.ac.kr/~isapa>

VIIth IOC Olympic World Congress on Sport Sciences

Physical, Nutritional and Psychological care of the Athlete in the 21st century

Congress will be held: at "The Athens Hilton Hotel"

7-11 October 2003, Registration, Accommodation and Travel:

www.iocworldcongress.com (from November 2002)

E-mail: ioc.worldcongress@athens2004.gr. Contact for more Information:

Angelika Chantzou Congress Secretariat

Tel: +30 10 2004 053. Fax: + 30 10 2004 099

E-mail: axantzou@athens2004.gr

Pre-Olympic Congress 2004

Thessaloniki, Greece. 6-11 August, 2004

Congress Secretariat ARTION Conference & Events 24, Ag. Sofias str.

GR-546 22 THESSALONIKI GREECE

Tel.: +30310 250926 (Cont. Line), + 30310 252330. Fax: +30 310 272276

E-mail: preolympic2004@artion.com.gr

Site: www.preolympic2004.com

ECSS SALZBURG 2003

**8th ANNUAL CONGRESS
EUROPEAN COLLEGE
OF SPORT SCIENCE**

July 9-12, 2003
Salzburg
Austria

First Announcement

Those Magic Free Radicals

Conversation with Dr. Zsolt Radák PhD, new board member of the International Council of Sport Science and Physical Education

Dr. Zsolt Radák is an Associate Professor, Vice-Dean (for science) at the Faculty of Physical Education and Sport Science, Semmelweis University in Budapest, Hungary. He has worked in the field of sport biomechanics and training theory then, during the last decade of his carrier, he has become interested in free radical physiology, its effects on exercise and aging, oxidative stress and repair.

The young, still only forty one year old professor, one of the internationally recognized outstanding representatives of the new Hungarian sport scientist generation received his PhD from the Hungarian University of Physical Education in 1990 and from the University Tsukuba, Japan in 1996. In 1998 he was given a Senior Research Fellowship by the Japanese Foundation of Aging and Health, and in 1999 he also received Hungary's Bolyai Research Fellowship in Medicine. He is a distinguished member of the American College of Sports Medicine as well as of the Oxygen Society. His articles have been published in many different domestic and foreign periodicals, in the Journal of Applied Physiology, Free Radical Biological Medicine among others and further he edited in 2000 a book titled "Free Radicals in Exercise and Aging" which was published in the United States by Human Kinetics. In 2002 he became board member of ICSSPE, the international organization of sports science and physical education.

The interview with him for the Hungarian Review of Sport Science was taken place in his office in December 2002.

Question: *Before trying to discover your unique Japanese connections I would like you to describe for us your circumstances, the main reasons and interest in studying at the Hungarian University of Physical Education after high school graduation in Csurgó?*

Answer: Back in 1984 I was lucky to have an excellent physical education teacher, namely Ferenc Káta. I just wanted to be like him and follow his path in many respects. Besides, I loved his classes, his philosophy, I also enjoyed playing and training in many different sports under his guidance, especially javelin throw. So I decided to try and enter the famous and popular Hungarian University of Physical Education, although knowing it would not be easy because of the extremely high number of applicants every year - usually 5 or 6 times more than the allowable maximum number of students for the first year. We, both my tutor and myself were successful and I got the green light for the first try.

Q: *How your attention turned to the close relationship between exercises and free radicals and where and how your devotion towards the behaviour of molecular oxygen and reactive oxygen originated in your research activity?*

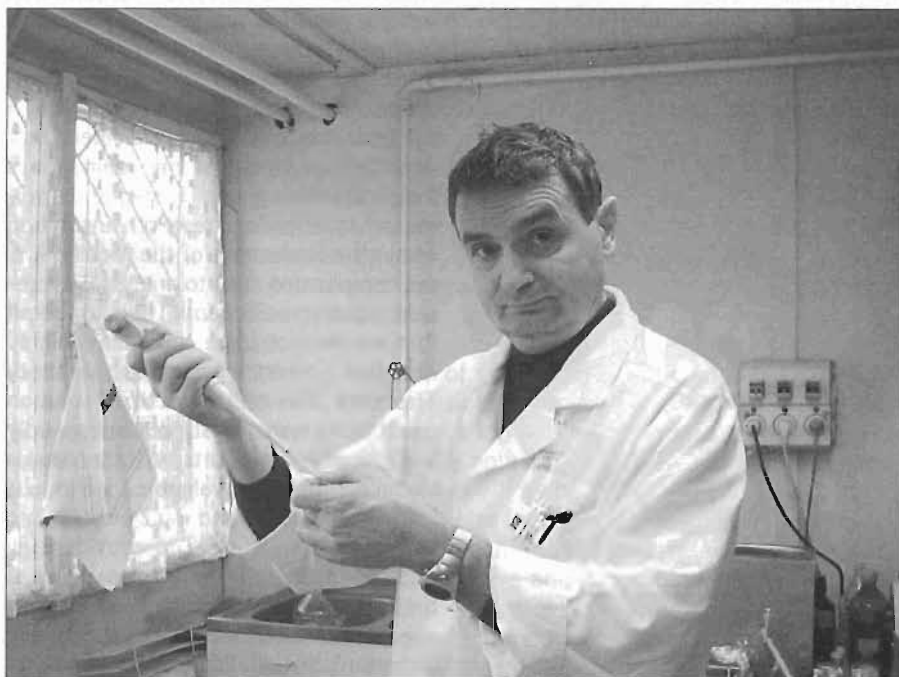
A: I coached one of the most talented Hungarian national team member javelin throwers meanwhile and after studying at the university and when she suffered a rather serious deep back muscle injury I

tried to speed up her healing process by adapting adequate exercises. The result was amazing, I got excited about the opening perspectives of the subject and I am still similarly very enthusiastic about it even today.

Q: *In the early nineties you and your family - wife and daughter - spent almost five years in Japan, your son was born there. If our information is correct, you were the very first visiting researcher in Tsukuba University from Europe. Where this idea, that is to go to Japan, had come from? ...And also if you would not*

mind, please, tell us something about this particular university and city...

A: Even if it could seem complicated enough, however it was not at all. I was looking for a promising scientific institution in order to get my PhD. I studied different possibilities of the available applications and the Japanese offer attracted my imagination most. I was supposed to take the entrance exam to the PhD course in Japanese but I got lucky, they made an exception which meant that I had to understand Japanese but at the same time I was allowed to give answers in English. Of course, the whole PhD program was running in Japanese... The city?... Tsukuba is the "Science capital" of Japan, was built specially for the Scientific World Expo. There are approximately three hundred different scientific research institutions including the university itself with the student population of twenty thousand. In this extraordinary environment not less than three Nobel Prize Winner scientists worked and I have had the exceptional opportunity to work with one of them, Dr. Leo Esaki, who was awarded with the prize of physics in 1973... Some times, you know, little things can help you to make up your mind. Around the time when I was considering to apply for the Japanese chance, I happened to read about Mr. Akio Morita, the founder and owner of the world famous Sony Co... His chief



executive officer once told him: "I want to quit, because we are always fighting, frequently argue and have opposing opinions."...President Morita's cool reaction was the following:" If you would always agree with me, why should I need you for?!...For me, this manifestation about the high value of challenging scientific arguments and healthy debate was really sympathetic.

Q: *Going through your research activity and follow your publications and contributions to various books, someone might say, you are absolutely obsessed with movement, motion, exercises and further - their correlation with free radicals, the plus electron of oxygen, O₂ - the magical capability of adaptation by the human body due to cleverly constructed manipulation of exercises... At this point we should add to this, that your research area seems to be closer to medical science than to the one of sport.*

A: They can share the results nicely together, there is no conflict what so ever. The conclusions of our research hopefully can contribute on many ways for the advancement of both areas. It is true, this is - the connection between the free radicals and exercise - definitely my favourite theme and based upon our experiment and findings, I am confident we can help considerably our fight against severe diseases like Alzheimer as well as different kinds of cancer and various contagious illnesses caused by viruses.

Q: *You spend one or two month each year in Japan working together with your colleges there as a visiting researcher and of course you have your duties here in Budapest too. Not an easy task, rather a double physical and mental load you have to stand... What is your recent subject to work on?*

A: I am just not able to spend more time in the Far East because my job requires my presence practically all year long in Budapest. It means that during my one or two months stay in Japan I have to accomplish enough work normally for one complete year...Daily 16-18 hours...My understanding wife use to say that I am a workaholic...However there is no other way or compromise... On the other hand, it is a great satisfaction to study and work on the recent area of my interest, for instance, the questions of overtraining, its effects and what we can do all about these things...An other undertaking is a book on cellular and molecular exercise physiology, compiled and edited by Frank C. Mooren, assistant of Sport Medicine and Internal Medicine at Münster University. With Dr. Godo, my Japanese colleague we will contribute a chapter together to this volume on general aspects of protein metabolism and on exercise effects regarding this metabolism. I am looking forward to all the works for this publication.

Q: *From the beginning of the fall semesters you have been working as Vice-Dean of the Faculty of Physical Education and Sport Science at Semmelweis University. Taking into consideration the financial and organizational difficulties which are the characteristic symptoms of the ongoing transitional period for the Hungarian University and College system, how could you define your goals and describe the perspectives?*

A: This position is a great honour and undeniably a deeply felt heavy responsibility too for me. And I also would like to say, there is the sober reality, certain limitations you must not ignore in trying to live up to your expectations. However I would like to remind you: when I composed my application for the job, I enclosed my plans and indicated very decisively in it one of my main goals, that is to build up step by step and operate an independent research institution within the framework of the faculty. It is not complicated at all to analyse our present situation. Someone has to admit that we do not have too many highly qualified sport scientists around. Therefore the only practical solution could be to concentrate our supposedly well coordinated efforts, in other words to collect the most valuable individuals, leading scientists and place them into this institution in order to provide high quality service for other professionals of the various sports departments. Five-six super professors can help in solving important and challenging problems for

PRE-OLYMPIC CONGRESS
2004

SPORT SCIENCE
THROUGH THE AGES
CHALLENGES IN THE NEW MILLENNIUM

6-11 August
2004
Thessaloniki
Greece

Organized by: FCSSE, CIPESS

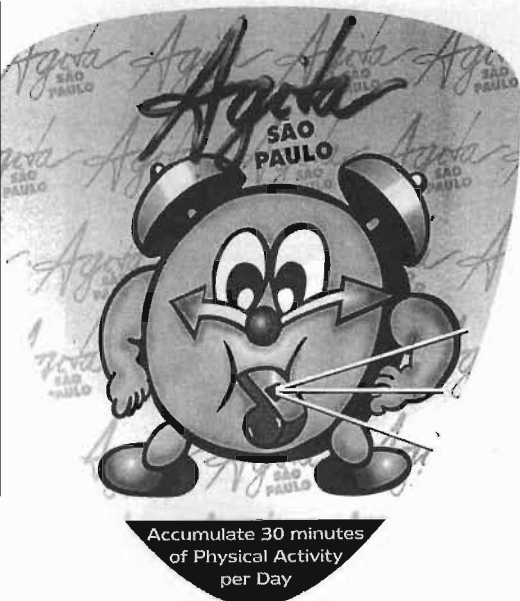
ARISTOTLE UNIVERSITY OF THESSALONIKI
DEPARTMENT OF PHYSICAL EDUCATION & SPORTS SCIENCE

PRELIMINARY ANNOUNCEMENT

other thirty or forty colleagues. This structure obviously requires considerable financial assistance by the higher authorities, ministries and I hope, eventually they will understand that without necessary budget sources the education of the new generation of professionals would be simple impossible.

Here it this point I would like to refer to my experience in Japan. The economy steadily declined there in the last decade, as we all know it well. Therefore in their yearly budget they had to cut the expenditure - more or less - for almost every major projects of their ministries and other state agencies - except the area of science!...Without it, they realized and knew well - there is no future!...So, there is a long way ahead, but I am optimistic after all and I tell you, on our own, we already have made the first encouraging steps into the right direction of creating the mentioned institution.

Thank you very much for your time, professor, and we wish the best of luck as far as the realization of your ambitious plans are concerned. Rezső Gallov



Round Table of Ministers of Physical Education and Sport

(Paris, January 9-10, 2003)

POSITION OF THE INTERNATIONAL COUNCIL OF SPORT SCIENCE AND PHYSICAL EDUCATION

1. Strengthening physical education and sport in the educational environment

The International Council of Sport Science and Physical Education was the initiator of the first comprehensive, world-wide audit on the state and status of physical education, and of the World Summit on Physical Education in Berlin, Nov. 3-5, 1999, which received patronage and support from UNESCO, the World Health Organisation and the IOC. We are very pleased that there is now an international consensus that this issue deserves serious consideration, in order to solve existing and future problems. We are encouraged by the very positive support given to progressing access to physical education and sport by all contributors to the discussion.

The World Summit on Physical Education offered an opportunity to discuss physical education from different scientific angles. Topics of keynote addresses included:

- State and status of physical education in global context
- The case for physical education
- Good practice in physical education
- Nutritional needs for physical education
- Physical education and physical development
- Social, community development through physical education
- Physical education, health and well-being
- Physical education: economic considerations

Additionally, workshops were conducted on varied themes including:

- Physical Education in National Development and Reconstruction
- Inclusion and Integration
- Working towards a balanced curriculum
- Physical education, schools and community

Important findings from the international comparative survey brought up recurrent issues in many parts of the world, such as:

- Decreasing curriculum time allocation
- Budgetary constraints with inadequate financial, material and personnel resources
- Low subject status and esteem
- Marginalisation and under-valuation by authorities

In the physical education profession and in academia, there is now a consensus that the issue of physical education deserves serious consideration in all nations worldwide. Data from all regions of the world show a steady increase in health problems linked to the lack of physical activity. At the same time, recent studies show that physically active students tend to perform better in academic subjects. "Quality" is the key to successful future developments, especially with regard to:

- Physical education programmes in the schools
- Co-operation between schools, community and clubs
- Professional training in universities and in-service training.

At the end of the World Summit on Physical Education, the participants adopted the "Berlin Agenda for Action for Government Ministers" which states:

"The World Summit on Physical Education reinforces the importance of Physical Education as a life-long process. It is particularly important for every child as articulated in the International Convention on the Rights of the Child. All children have a right to:

- (1) the highest level of health,
- (2) free compulsory primary education for both cognitive and physical development,
- (3) rest and leisure,
- (4) play and recreation."

ICSSPE urges Member states to take action to sustain a positive future for physical education and sport in schools and the wider community by placing emphasis on the quality of delivery of physical education and sport. This includes:

- appropriate teacher training preparation,
- regular required in-service teacher training,
- development of physical education curricula which are relevant to individuals and 21st century life-style patterns,
- improved education regarding issues related to the fight against doping,
- inclusion policies for gender and disability-related issues to provide equal opportunities for boys and girls and young people with disabilities.

Such inclusion policies need to be translated into school, out-of-school and post-school community settings through facilitation of multi-sector partnership links. ICSSPE also urges all Member States to keep a watching brief on developments and monitor the implementation of policy promises into reality.

International research results provide a challenge to address the status and resources of physical education. Most governments are working hard to balance the overwhelming number of requests for their limited resources. However, when physical education is not incorporated as an integral part of education programs, the consequences can be long/lasting and manifold. The issue can be summarised by the following slogan: "Pay for physical education now. Or pay - much more - later for the damage done."

Physical education can and does provide a large number of health, social, cognitive and economic benefits. Physical education can and does provide a return on investment in other areas of spending, most notably health.

Based on the evidence available, we ask Member States

to effectively implement the Declaration of Punta del Este and the recommendations of MINEPS III. Governments and civil society, working together, can make a difference for our most precious resource – today's children and youth. This is an international problem requiring international, national and local action.

Selected literature

Doll-Tepper G. & Scoretz D.: Proceedings of the World Summit on Physical Education. International Council of Sport Science and Physical Education, Berlin 2001. (available in English, German, Chinese, Polish, Japanese)

Hardman K. & Marshall J.: World-wide Survey of the State and Status of School Physical Education – Summary Findings. University of Manchester, Manchester 1999.

2. Protection of young athletes

The International Council of Sport Science and Physical Education is pleased to have the opportunity to make an intervention on the protection of young athletes, from the point of view of practitioners in physical education, sport and research.

As pointed out in the annotated agenda, young athletes and children engaged in sport and physical activity are often exposed to risks and threats which are a direct consequence of either unsuitable practices of sport, or of inappropriate conditions and settings. Exploitation of children and youth in sport can be diverse and manifold, leading to damage to their personal and/or material well-being and the integrity of their personality, up to being subject to criminal behaviour such as sexual and physical harassment and abuse. Sadly, sport can be a magnet for child abusers.

Sport cannot have separate status with regard to commonly accepted standards for the ethical treatment of, and care for children and youth. Children and youth have a right to play, rest, and education, as stated in the International Convention for the Rights of Children. The world of sport must make sure that children and youth are treated with due care and respect, through the development of models of good practice. Effective and professional preparation of teachers and coaches is one of the keys to achieve this, and it is essential that all the people concerned with the sport experience of young people share the same values of respect for both sport and the dignity of the young people they serve.

Governments must make sure that the provisions pertaining to the rights of children and youth are respected in their countries, and that existing regulations against child abuse and child labour are applied as well. When such regulations are missing, Member states should adopt such legislative texts as soon as possible. It is necessary to end the exploitation of children and young athletes for doubtful purposes, whether commercial or political.

It is noteworthy that in many cases, it has been the educational community and academic researchers, who have shown the commitment and courage to raise awareness of this issue, especially sexual harassment and abuse. Where sports organisations have worked positively with these researchers to address the problem, especially when they have been supported by governments, there have been very positive results. Sports organisations should recognise their own responsibilities for developing good practice in child protection and preparing children and young people to make informed decisions in sport. To ensure healthy children and young people, we have to ensure healthy sport.

3. Drafting of an international legal instrument to combat doping in sport

ICSSPE fully supports the work undertaken by WADA and recommends that governments and sport organisations continue to work co-operatively to solve the issue of doping. On both the international and national level, a co-operative approach should be favoured instead of a coercive one.

We hope that the efforts of WADA will result in internationally accepted standards for the fight against doping, which will then be adapted to the particular national legal systems. The unethical and destructive behaviours linked to the practice of doping, which sometimes includes the encouragement of such practices by various institutions such as some sport teams, deserve a strong reaction and effective instruments to end it.

All stakeholders must take responsibility for their deeds and will have to be judged by their actions in the future. Effective control mechanisms concerning the production and distribution by the pharmaceutical industry of products which can be misused for doping practices, as well as concerning the manufacturing and uncontrolled distribution of dubious so-called "food supplements", should be put in place and implemented by the responsible bodies at the international and national level.

As stated by the representative of FIMS, future teachers and coaches should be made fully aware of their responsibilities in the fight against doping. This must be reflected in their education and training at all levels.

ICSSPE also points out the crucial role of education, in raising the awareness of young people, regarding the ethical, health and moral dangers of doping. By positively promoting the value of fair play, and of engagement in sport for its own sake, physical education in schools can support the legislative and regulatory activities of WADA and governmental intervention, in the most positive way.

Finally, ICSSPE and its member organisations are committed to support every effort to coordinate and disseminate research undertaken on all relevant fields of study, and work cooperatively with WADA for this purpose.



The first Round Table of Ministers of Physical Education and Sport took place at the UNESCO Headquarters in Paris on January 9-10, 2003. ICSSPE was represented by Prof. Dr. Gudrun Doll-Tepper, ICSSPE President, Prof. Dr. Margaret Talbot, ICSSPE Vice-President and IAPESGW, and Christophe Mailliet, ICSSPE Executive Director.

The first part of the statements ("Strengthening physical education and sport in the educational environment") was presented by Prof. Dr. Gudrun Doll-Tepper as an introductory keynote speech for the session on this theme. Parts 2 and 3 (Protection of young athletes/International legal document against doping) were presented respectively by Prof. Dr. Margaret Talbot and Prof. Dr. Gudrun Doll-Tepper during the debates.

The statements above has been published by kind permission of Prof. Dr. Gudrun Doll-Tepper, ICSSPE President. For more information, please contact either the ICSSPE Office or Mr. Marcellin Dally at UNESCO (m.dally@unesco.org).

International Council of Sport Science and Physical Education (ICSSPE/CIEPSS) Am Kleinen Wannsee 6 14109 Berlin GERMANY, Tel. +49-30-80500360 Fax +49-30-8056386

E-mail: icsspe@icsspe.org. Internet: <http://www.icsspe.org>

The International Council of Sport Science and Physical Education

ICSSPE Executive Board

President

Prof. Dr. Gudrun Doll-Tepper
Institute of Sport Science -
Freie Universität Berlin
Fabeckstraße 69
14195 Berlin, GERMANY
tel. +49 30 83853183
fax +49 30 838 55837
e-mail: gudrundt@zedat.fu
berlin.de

Vice-President 'Scientific Services'

Dr. Colin Higgs
School of Human Kinetics
and Recreation
Memorial University of
Newfoundland
St. John's, Newfoundland A1C
5S7
CANADA
tel. +1 709 737 81 29
fax +1 709 737 35 24
e-mail:
chiggs@morgan.ucs.mun.ca

Vice-President 'Sport Sciences'

Prof. Dr. Tony Parker
Queensland University of
Technology
School of Human Movement
Studies
Locked Bag No. 2
Victoria Park Road
Kelvin Grove Qld 4059
AUSTRALIA
tel. +61 738643512
fax +61 738643980
e-mail: T.Parker@QUT.EDU.AU

Vice-President 'Physical Education, Physical Activity and Sport'

Prof. Dr. Margaret Talbot
Central Council of Physical Recre-
ation
Francis House
Francis Street
London SW1P 1DE
UNITED KINGDOM
tel. +44 207 854 8500
fax +44 207 854 8501
e-mail: M.Talbot@ccpr.org.uk

Speaker Associations' Board

Dr. Karen DePauw
International Federation of
Adapted Physical Activity
Virginia Tech Graduate School
(0325)
Sandy Hall
24061 Blacksburg, VA
USA
tel. +1 540 2317581
fax +1 540 2311670
e-mail: kdepauw@vt.edu

Editorial Board Chairperson

Prof. em. Dr. Jan Borms
Vrije Universiteit Brussel
Faculty of PE and Physical Therapy
Human Biometry, Health Promo-
tion

Pleinlaan 2
1050 Brussel
BELGIUM
tel. +32 2 6292734
fax +32 2 6292736
e-mail: jlborms@vub.ac.be

Treasurer (a.i.) (outgoing Dec 2002)

Prof. Dr. James Skinner
11001 North 26th Street
Phoenix, AZ 85028
USA
tel. +1 602 4858371
fax +1 602 4858371
e-mail: jskinner@iupui.edu

Treasurer (incoming Jan 2003)

Dr. Darlene A. Kluka
Associate Professor, Coordinator
Health & PE
Grambling State University
Dept. of HPER
PO 1193
71245 Grambling, Louisiana
USA
tel. +1 318 274 2294
fax +1 318 274 6053
internet: www.gram.edu
e-mail: eyesport@aol.com

Executive Director

Mr. Christophe Mailliet
ICSSPE Office
Am Kleinen Wannsee 6
14109 Berlin
GERMANY
tel. +49 30 80500360/61/62
fax +49 30 8056386
internet: www.icsspe.org
e-mail: cmailliet@icsspe.org

Regional Co-ordinator Africa

Prof. Dr. Lateef O. Amusa
University of Venda for Science
and Technology
Centre for Biokinetics, Recreation
& Sport Science
Private Bag X5050
0950 Thohoyandou
SOUTH AFRICA
tel. +267 3555003
fax +267 585096
e-mail: amusa@wallyahoo.com

Regional Co-ordinator Asia

Prof. Jin Ji-Chun
Beijing University of Physical Edu-
cation
Haidian
North Road of Zhongguancun
100084 Beijing
P.R. OF CHINA
tel. +86 10 62989713
fax +86 10 62989297
e-mail: JIJC4190@sina.com.cn,
bujep@public.bta.net.cn

Regional Co-ordinator Arab Region

Dr. Essam Badawy
National Sport Research Center
Ministry of Youth and Sport Build-
ing
26 July Street

Meet-Okba
Giza, EGYPT
tel. +20 2 3470923
fax +20 2 3444429

Regional Co-ordinator

Australia/Oceania
Dr. Graham Costin
Queensland University of Technol-
ogy
School of Human Movement
Studies
Kelvin Grove
Victoria Park Road
Kelvin Grove Qld 4059
AUSTRALIA
tel. +61 738643980
fax +61 738643980
e-mail: g.costin@qut.edu.au

Regional Co-ordinator Eastern Europe

Mr. Pierre Joseph de Hillerin
Centrul de Cercetari Pentru Pro-
bleme de Sport, sector 2
B-dul Basarabi nr. 37-39
73403 Bucharest
ROMANIA
tel. +40 1 3249104
fax +40 1 3249149
e-mail: hillerin@sports-science.ro

Regional Co-ordinator Western Europe

Prof. Dr. Roland Naul
Willibald Gerhardt Research Insti-
tute
Altendorfer Str. 3
45127 Essen
GERMANY
tel. +49 201 8315410
+49 201 1837614
fax +49 201 1837624
e-mail: roland.naul@uni-essen.de

Regional Co-ordinator Latin America

Prof. Dr. Victor Matsudo
Physical Fitness Research Labora-
tory of Sao Caetano do Sul -
CELAFISCS
Av. Goiás, 1400
09520 Sao Caetano do Sul
BRAZIL
tel. +55 114358980
fax +55 114359643
internet: www.celafiscs.com.br
e-mail: celafiscs@celafiscs.com.br,
matsudo@osite.com.br

Regional Co-ordinator North America

Prof. Dr. Bruce Kidd
Faculty of Physical Education &
Health
University of Toronto
55 Harbord Street
Toronto, Ontario M5S 2W6
CANADA
tel. +1 416 9787943
fax +1 416 9786978
internet: www.utoronto.ca/physi-
cal
e-mail: bruce.kidd@utoronto.ca

Prof. Dr. Tadeusz Bober
Academy of Physical Education
Dept. of Biomechanics
ul. Paderewskiego 35
51-617 Wrocław
POLAND
tel. +48 71 3487077
fax +48 71 3482281
e-mail: tbober@netra.awf.wroc.pl

Dr. Richard J. Fisher
St. Mary's University College
Physical Education Department
Strawberry Hill, Twickenham
Middx. TW1 4SX
UNITED KINGDOM
tel. +44 208 2404123
fax +44 208 2404255
internet: www.smuc.ac.uk
e-mail: rfisher@smuc.ac.uk

Dr. Keith Gilbert
e-mail: keith_gilbert@hotmail.com

Prof. Dr. Ommo Grupe
Eberhard-Karls-Universität Tübingen
Inst. für Sportwissenschaft
Wilhelmstraße 124
72074 Tübingen
GERMANY
tel. +49 7071 2972628
fax +49 7071 292078
e-mail: ommo.grupe@uni-tuebin-
gen.de

Dr. Ken Hardman
International Society for Compar-
ative Physical Education and
Sport (ISCPE)
Centre for PE & Leisure Studies,
University of Manchester
Oxford Road
Manchester M13 9PL
UNITED KINGDOM
tel. +44 161 2754964
fax +44 161 2754962
internet: http://iscpes.uwo.ca
e-mail:
Ken.Hardman@btinternet.com

Ms. Susi-Kathi Jost
Swiss Olympic Association
Ob. Aareggweg 114
3004 Bern
SWITZERLAND
tel. +41 79 203 02 38 (mobile)
fax +41 31 302 41 88
e-mail: susi-kathi.jost@bluwin.ch

Dr. Michael McNamee
University of Gloucestershire
Leisure and Research Unit
Cheltenham, Glos. GL50 4AZ
UNITED KINGDOM
tel. +[home] 44 144678 1476
e-mail: mmcnamee@glos.ac.uk

Dr. Zsolt Radák
Szemmelweis Egyetem Testnevelési
és Sporttudományi Kar.
Alkotás u. 44
1123 Budapest
HUNGARY
internet: www.hupe.hu

Prof. Dr. Alicja Rutkowska-Kucharska
Academy of Physical Education
Dept. of Biomechanics
ul. Paderewskiego 35
51-617 Wrocław
POLAND
fax +48 71 3482281

Dr. Claude Tabet
Rue des Hayettes 311
62700 Bruay-La-Buissière
FRANCE
tel. +33 321 691108
fax +33 321 532122
e-mail: Claude.TABET@wanadoo.fr

Mr. Lauri Tarasti
Supreme Administrative Court
Unioninkatu 16
00130 Helsinki
FINLAND
tel. +358 9 1853315
fax +358 9 1853382
e-mail: lauri.tarasti@om.fi

Dr. Karin A.E. Volkwein
International Association of Phi-
losophy of Sport
West Chester University
Department of Kinesiology
19383 West Chester, PA
USA
tel. +1 610 4362153
fax +1 610 4362860
e-mail: kvolkwein@wcupa.edu

Dr. Anita White
South Bank
Ringwood South Bank
Chichester, West Sussex PO19
2DX
UNITED KINGDOM
tel. +44 1243 785217
e-mail:
anitawhite_uk@hotmail.com

**Associations' Board Representa-
tive**
Prof. Dr. Ronald S. Feingold
Association Internationale des
Ecoles Supérieures d'Éducation
Physique (AIESEP)
Adelphi University, PE and Human Perfor-
mance Science
Woodruff Hall
11530 Garden City, New York
USA
tel. +1 516 877 4262
fax +1 516 874258
e-mail: FEINGOLD@adelphi.edu

**Associations' Board Representa-
tive**
Mag. Julika Ullmann
Ref. Leibeseziehung und Schul-
sport
Landesschulrat F. Niederösterreich
Rennbahnstr. 29
3109 St. Pölten
AUSTRIA
tel. +2742 280 4570
fax +2742 280 1111
e-mail: julika.ullmann@lsr-
noe.gv.at

ICSSPE Associations' Board

Speaker
Dr. Karen DePauw
Address - see Executive Board

Association Internationale des Ecoles Supérieures d'Éducation Physique (AIESEP)

Prof. Dr. Ronald S. Feingold
President
Adelphi University, PE and Human Perfor-
mance Science
Woodruff Hall
11530 Garden City, New York
USA
tel. +1 516 877 4262

fax +1 516 8774258
e-mail: FEINGOLD@adelphi.edu

**Fédération Internationale d'Éducation
Physique (FIEP)**
Prof. Dr. Manoel José Gomes Tubino
President

Rua Souza Lima 185
22081-010 Rio De Janeiro
BRAZIL
tel. +55 215217850
fax +55 215219833
e-mail: manoeltubino@aol.com,
bicaldas@nionet.com.br

**International Association for Sports and
Leisure Facilities (IAKS)**
Siegfried Hoymann, Secretary General

Carl-Diem-Weg 3
50933 Köln
GERMANY
tel. +49 221 4912991
fax +49 221 4971280
e-mail: IAKS-@t-online.de

International Association for Sports Infor- mation (IASI)

Alain Poncet, President
c/o Institut National du Sport et de
l'Éducation Physique
11, avenue du Tremblay
75012 Paris
FRANCE
tel. +33 147144119
fax +33 148081960
e-mail: alain.poncet@inssep.fr

**International Association of
Philosophy of Sport**
Dr. Karin A. E. Volkwein
West Chester University
Department of Kinesiology
19383 West Chester, PA
USA
tel. +1 610 4362153
fax +1 610 4362860
e-mail: kvolkwein@wcupa.edu

**International Association of Physical Edu-
cation and Sport for Girls and Women (IA-
PESGW)**
Prof. Dr. Margaret Talbot
c/o Central Council of Physical
Recreation
Francis House

Conseil International pour l'Education Physique et la Science du Sport

ICSSPE Associations' Board

Francis Street
London SW1P 1DE
UNITED KINGDOM
tel. +44 207 854 8500
fax +44 207 854 8501
e-mail: M.Talbot@ccpr.org.uk

International Federation of Adapted Physical Activity (IFAPA)
Dr. Karen P. DePauw
Virginia Tech Graduate School (0325)
Sandy Hall
24061 Blacksburg, VA, USA
tel. +1 540 2317581
fax +1 540 2311670
e-mail: kpdepauw@vt.edu

International Paralympic Committee (IPC)
Mr. Philip Craven
President
Adenauerallee 212
53113 Bonn
GERMANY
tel. +49 228 2097200
fax +49 228 2097209
e-mail: info@paralympic.org

International Society for Comparative Physical Education and Sport (ICSPES)
Prof. Dr. Jan Tolleneer
KU Leuven, Faculty of PE and Physiotherapy
Tervuursevest 101
3001 Leuven
BELGIUM
tel. +32 16 329005
fax +32 16 329196

internet: icspes.uwo.ca
e-mail: Jan.Tolleneer@kulak.ac.be

International Society for Sports Psychology (ISSP)
Prof. Dr. Keith P. Henschen
President
c/o Dept. of Exercise and Sport Science
University of Utah
250 S. 1850 E. Rm. 200
Salt Lake City UT 84112-0920
USA
tel. +1 801 5817558
fax +1 801 5853992
internet: www.issponline.org
e-mail: Keith.Henschen@health.utah.edu

International Society for the Advancement of Kinanthropometry (ISAK)
Prof. Dr. Mike Marfell-Jones
President
UCOL, Chair of Health Sciences
Private Bag 11 022
Palmerston North
NEW ZEALAND
tel. +64 6 9527001
fax +64 6 9527002
e-mail: M.Marfell-Jones@ucol.ac.nz

International Society for the Advancement of Kinanthropometry (ISAK)
Dr. Kevin Norton
Secretary General
School of PE, Exercise and Sport Studies
University of S. Australia, Mawson Lakes Rd
5032 Underdale
SOUTH AUSTRALIA
tel. +61 883026598
fax +61 883026658

internet:
<http://freshedu.aut.ac.nz/ISAK/>
e-mail: kevin.norton@unisa.edu.au

International Society for the History of Physical Education and Sport (ISHPES)
Prof. Dr. Thierry Terret
President
Université Lyon 1 - CRIS
27-29 Bd du 11 novembre 1918
69622 Villeurbanne cedex
FRANCE
tel. +33 472 43 10 92
fax +33 472 44 80 27
internet:
www.umist.ac.uk/UMIST_Sport/ishpes2.html
e-mail: Thierry.Terret@univ-lyon1.fr

International Sociology of Sport Association (ISSA)
Prof. Dr. Joseph Maguire
President
Loughborough University
Dept. of PE, Sport Science
Loughborough LE11 3TU
UNITED KINGDOM
tel. +44 1509 223328
fax +44 1509 223971
e-mail: J.A.Maguire@lboro.ac.uk

International Sociology of Sport Association (ISSA)
Prof. Dr. Janet C. Harris
California State University, Dept. of Kinesiology and PE
5151 State University Drive
90032 Los Angeles, CA
USA

tel. +1 323 343 4650
fax +1 323 343 6482
e-mail: jharris2@calstatela.edu
International Sports Press Association (AIPS)
Togay Bayatli, President
President's Office AIPS
34740 Atakey
Istanbul
TURKEY
tel. +90 212 5600707
fax +90 212 5600055
internet:
www.vol.net.tr/org/aips_mediasport/index.htm/
e-mail: aips@mail.mata.v.tr

Physical Fitness Research Laboratory of Sao Caetano do Sul - CELAFISCS
Prof. Dr. Victor Matsudo
Av. Goiás, 1400
09520 Sao Caetano do Sul
BRAZIL
tel. +55 114358980
fax +55 114359643
internet: www.celafiscs.com.br
e-mail: celafiscs@celafiscs.com.br,
matsudo@osite.com.br

Trim and Fitness International Sport for All Association (TAFISA)
Prof. Dr. Jürgen Palm
Hubertusanlage 32
63159 Heusenstamm
GERMANY
tel. +49 6106 4421
fax +49 6106 5399
e-mail: juergenpalm@aol.com

ICSSPE Editorial Board

Editorial Board Chairperson
Prof. em. Dr. Jan Borms
Address - See Executive Board

Editorial Board Members
Ms. Gretchen Ghent
University of Calgary Law Library
2500 University Dr. NW
Calgary T2N 1N4
CANADA
tel. +403 220 6097
fax +403 282 6837
e-mail: gghent@ucalgary.ca

Prof. Dr. Herbert Haag
Christian-Albrechts-Universität Kiel
Institut für Sport und Sportwissenschaften
Olshausenstrasse 74
24098 Kiel
GERMANY
tel. +49 4318803770
fax +49 431 8803773
internet: www.uni-kiel.de

e-mail: sportpaed@email.uni-kiel.de
Prof. Dr. Colin Higgs
Address - See Executive Board

Dr. Denise Jones
University of the Western Cape
Dept. of Human Movement Studies
Private Bag 7535
Belleville
SOUTH AFRICA
tel. +27 21 959 2245
fax +27 21 959 3688
e-mail: d.jones@uwc.ac.za

Dr. Darlene A. Kluka
Address - See Executive Board

Dr. András Monus
Hungarian Society of Sport Science
Dózsa György út 1-3
1143 Budapest
HUNGARY
tel. +36 1 2215674
fax +36 1 2215674
e-mail: andras.monus@ella.hu,
mstt@ella.hu

Dr. Pekka Oja
UKK Institute
P.O. Box 30
33501 Tampere
FINLAND
tel. +358 3 2829 111
fax +3 2829 559
e-mail: ukpeoj@uta.fi,
pekka.oja@uta.fi

Dr. William F. Stier
University of New York
Physical Education and Sport
Sport Management
Brookport, New York NY 14420
USA
tel. +1 716 395 5331
fax +1 716 393 2771
e-mail: bstier@brockport.edu

ICSSPE Publications & Scientific Affairs Manager
Ms. Amanda Smyth
ICSSPE/CIPESS Executive Office
Am Kleinen Wannsee 6
14109 Berlin

GERMANY
tel. +49 30 80500362
fax +49 30 8056386
e-mail: asmith@icsspe.org
internet: www.icsspe.org

Editorial Board Advisors
Assoc. Prof. Dr. Andrew Hills
Queensland University of Technology
Victoria Park Rd
4059 Kelvin Grove
AUSTRALIA
tel. +61 7 3864 3286
fax +61 7 3864 3980
e-mail: a.hills@qut.edu.au

Dr. Jonathan Reeser
Marshfield Clinic
Dept. of Physical Medicine
1000 North Oak Avenue
54449 Marshfield, Wisconsin
USA
tel. +1 715 387 5327
fax +1 715 387 5776
e-mail: jreeser@tznnet.com

Working Groups

International Committee of Sport Pedagogy (ICSP)
Mag. Julika Ullmann, Chairperson
Ref. Leibeserziehung und Schulsport
Landesschulrat f. Niederösterreich
Rennbahnstr. 29, 3109 St. Pölten
AUSTRIA
tel. +2742 280 4570
fax +2742 280 1111
e-mail: julika.ullmann@sr-noe.gv.at

World Commission of Science and Sports (WCSS)
Prof. Dr. Thomas Reilly, President
John Moores University
Research Inst. for Sport & Exercise Studies
15-21 Webster Street
Liverpool L3 2ET
UNITED KINGDOM
tel. +44 151 2314323
fax +44 151 1314353
e-mail: t.p.reilly@livjm.ac.uk

ICSSPE Honorary Members

Dr. Don Anthony, TURKEY
Dr. Lloyd C. Arnold, USA
Sir Roger Bannister, UNITED KINGDOM
Ms. Patricia Bowen-West, UNITED KINGDOM
Mr. John Coghlan, UNITED KINGDOM

Prof. Dr. Günther Erbach, GERMANY
Prof. em. Dr. Marcel Hebbelinck, BELGIUM
Mr. Pierre Henquet, FRANCE
Prof. Dr. Paavo Komu, FINLAND
Prof. Dr. Tetsuo Meshizuka, JAPAN
Dr. András Monus, HUNGARY
Dr. Guido Schilling, SWITZERLAND
Mr. Werner Sonnenschein, GERMANY