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## TO THE IMPORTANT LIFE ANNIVERSARY OF PROF. PHDR. HANA VÁLKOVÁ, CSC., THE DEAN OF THE FACULTY OF PHYSICAL CULTURE, PALACKÝ UNIVERSITY IN OLOMOUC

Professor PhDr. Hana Válková, CSC., from January 2003 holds as a first woman, the function of the third dean of the Faculty of Physical Culture of Palacký University in Olomouc. Believing in the magical power of numbers we could also believe that the number three will mean further development and rise of the faculty.

Hana Válková (née Buchníčková) was born on 9<sup>th</sup> of July 1943 in Brno. She completed elementary school and secondary school of general education which she passed the school-leaving examination in 1960. From 1960 she studied at the Palacký University in Olomouc, field of her study was teaching profession of physical education and Czech language. In her free time she was keen on active sport especially athletics and her physical performance was at the Czechoslovak national level. Besides, she was a member of basketball team TJ Slávie VŠ Olomouc. She graduated in 1965 and her first real contact with teaching practice was at the elementary school and industrial school, she thinks that every university teacher should undergo this kind of teaching practice. Also in her personal life there was a change. Professor Válková married Mr. Drahomír Válek, known basketball coach of team Dukla Olomouc and she became mother of two sons. She didn't stop studying even in this period of time and she extended her teaching qualification for another discipline – Russian language.

In her life the turning point was the year 1969. In this year she was taken on the Department of physical education of Palacký University in Olomouc as a lecturer of teaching athletics and psychology. She was interested in psychology so much that in 1971 she completed this discipline at Faculty of Arts of Palacký University in Olomouc and in the following year she reached the doctor degree (PhDr.). Her dominant qualities were always diligence, tenacity and also continuous hastiness. From the beginning of her career she focused on the solving problems connected with the psychology of the physical education and sport and she also focused on the problems of teacher's personality. In the year 1975 she became the head of the Department of physical education, which she ran until the 1989. In the year 1981 she reached the CSC. degree (= Ph.D. degree) at the Faculty of Physical Education and Sport of Charles University in Prague and in the 1985 at the same faculty she took a higher doctorate in the field of physical education teaching theory. In the year 1988 she completed her postgraduate studies at Charles University in Prague, discipline – English language. In the years 1987–1989 she was vice-dean of the Faculty of Education for the pedagogic affairs, she guaranteed the teaching studies of primary education and special pedagogy which she started to

be concerned with. She sat on many various committees e.g. commission for rigorous proceeding, entrance examination commission, state examination commission. She always belonged among the workers who wanted to be an example for the others especially by their labour and personal discipline. The years 1990–1991 were not easy for her. She departed to Great Britain in order to keep better English and experience in care, education and sports of persons with special needs. After that she professionally and scientifically broke through at the Department of Adapted Physical Education at the Faculty of Physical Culture of Palacký University in Olomouc. In the 1995 she was appointed as a head of this department. She still continued in her studies. In the year 1991 she successfully completed her studies of special pedagogy at the Faculty of Education of Palacký University, in the year 2000 she again took a higher doctorate in the field of study – kinanthropology sciences and in the 2002 she became a professor.

Pedagogical activities of Hana Válková are wide. At first she was teaching physical education and athletics then psychology of physical education and sport, special pedagogy and applied physical activities. For several years she actively contributed to the development of physical education and sport of persons with disability. She became an ardent promoter of integration of these people by means of physical activities.

At the faculty she is the author of curriculum for adapted physical education, she is an expert of Ministry of Education, Youth and Sport in the field of specialist preparation for the adapted physical activities, she was and still is teaching at the Masaryk University in Brno, at the Faculty of Education in České Budějovice, at the Technical University in Liberec, the Faculty of Medicine and the Faculty of Education of Palacký University in Olomouc and at universities abroad under Erasmus programme.

The topics of her research works also went through development from research of a sportsman personality to the teachers' personality and their professional preparation in kinanthropology subjects, she was concerned with the teacher activities with pupils and also graduates' fulfilment in practice. Nowadays she is especially interested in theory of applied physical activities. In the years 1991–2000 she was researcher of 16 grants and developing projects which brought in nearly one million Czech crowns every year for the faculty. Also her international activities are appreciable. She stands guarantor for European programmes of university cooperation, Socrates and Erasmus programmes and coordinator of network of Central European universities in CEEPUS programme. We must mention her membership in many prestigious socie-

ties. She is a member of Czech-Moravian Psychological Society, Czech Kinanthropology Society, Czech Special Olympic Movement (director of programme for education and research), European Federation of Sport Psychology (FEPSAC) and International Society of Sport Psychology (ISSP), Special Olympics International and many other international organizations.

We must appreciate professor Válková's vitality, diligence and activeness. Although she completes her sixtieth year of her life this year she is still young, full of vital optimism and enthusiasm.

We wish Dean Mrs. Válková to her important life anniversary good health, well-being and further success at her work which surely contribute to the development of the whole faculty and will be useful for its students, teachers and employees.

**K VÝZNAMNÉMU ŽIVOTNÍMU JUBILEU  
PROF. PHDR. HANY VÁLKOVÉ, CSC., DĚKANKY  
FAKULTY TĚLESNÉ KULTURY UNIVERZITY  
PALACKÉHO V OLOMOUCI**

Prof. PhDr. Hana Válková, CSc., zastává od února 2003 jako první žena funkci v pořadí již třetího děkana Fakulty tělesné kultury Univerzity Palackého v Olomouci. Věříme-li v magickou moc čísel, mohli bychom rovněž uvěřit tomu, že číslo tři bude znamenat pro fakultu její další rozvoj a rozkvět.

Hana Válková (roz. Buchníčková) se narodila 9. července 1943 v Brně. Absolvovala zde základní a střední všeobecně vzdělávací školu, kterou v roce 1960 zakončila maturitou. Od roku 1960 studovala na Univerzitě Palackého v Olomouci obor učitelství, a to tělesnou výchovu a český jazyk. Ve svém volném čase se věnovala aktivně sportu, zvláště atletice, a její výkonnost byla na úrovni československé reprezentace. Kromě toho byla členkou basketbalového družstva TJ Slávie VŠ Olomouc. Promovala v roce 1965 a učitelský křest, který by měl podle jejího mínění absolvovat každý vysokoškolský učitel, proběhl na základní a učňovské škole. Ke změně došlo také v jejím osobním životě. Prof. Válková se provdala za známého trenéra basketbalové Dukly Olomouc Drahomíra Válka a stala se matkou dvou synů. Ani v tomto období však nepřestává studovat, neboť si rozšířila svou aprobaci o obor ruský jazyk.

Mezníkem v jejím životě byl rok 1969. V tomto roce byla přijata na katedru tělesné výchovy Pedagogické fakulty Univerzity Palackého v Olomouci jako odborná asistentka pro výuku atletiky a psychologie. Problematika psychologie ji zaujala natolik, že tento obor v roce 1971 úspěšně vystudovala na Filozofické fakultě Univerzity Palackého v Olomouci a v následujícím roce dosáhla titulu PhDr. Její dominantní vlastností byla vždy píle, houževnatost, ale také stálý spěch. Od počátku se zaměřovala na řešení problémů psychologie tělesné výchovy a sportu i na problematiku osobnosti učitele. V roce 1975 se stala

vedoucí katedry tělesné výchovy a tuto katedru vedla až do roku 1989. V roce 1981 dosáhla titulu kandidáta věd na FTVS UK v Praze a na téže fakultě v roce 1985 habilitovala v oboru teorie vyučování tělesné výchovy. V roce 1988 dostudovala v rámci postgraduálního studia anglický jazyk na Univerzitě Karlově v Praze. V letech 1987–1989 byla proděkanou Pedagogické fakulty pro pedagogické záležitosti s garancí učitelského studia pro 1. stupeň základní školy a speciální pedagogiku, kterou se rovněž začala zabývat. V roce 1991 úspěšně skončila studium oboru speciální pedagogika na Pedagogické fakultě Univerzity Palackého. Pracovala v celé řadě komisí, např. v komisi pro rigorózní řízení, v přijímací komisi i v komisích pro státní zkoušky. Vždy patřila mezi ty pracovníky, kteří chtěli být svou pracovní disciplínou a osobní kázní příkladem pro ostatní. Léta 1990–1991 pro ni nebyla právě jednoduchá. Vycestovala do Velké Británie sbírat zkušenosti z oblasti aplikovaných pohybových aktivit a zdokonalit se v jazyce. Po návratu se pracovně i vědecky prosadila na katedře aplikované tělesné výchovy Fakulty tělesné kultury UP v Olomouci a v roce 1995 byla jmenována vedoucí tohoto pracoviště. V roce 2000 znovu habilitovala v oboru kinantropologických věd a v roce 2002 uspěla v profesorském řízení.

Pedagogická činnost Hany Válkové je velmi bohatá. Nejprve vyučovala tělesnou výchovu a atletiku, později psychologii tělesné výchovy a sportu, speciální pedagogiku a aplikované pohybové aktivity. Aktivně přispívala po řadu let k rozvoji tělesné výchovy a sportu osob se zdravotním postižením. Stala se zánícenou propagátorkou integrace osob se zdravotním postižením prostřednictvím pohybových aktivit.

Na fakultě je autorkou kurikula studijních programů aplikované tělesné výchovy, je expertkou MŠMT ČR v oblasti přípravy odborníků pro aplikované pohybové aktivity, vyučovala a vyučuje na Masarykově univerzitě v Brně, na Pedagogické fakultě v Českých Budějovicích, na Technické univerzitě v Liberci, na Lékařské fakultě a na Pedagogické fakultě Univerzity Palackého v Olomouci a v rámci programu Erasmus i na zahraničních univerzitách (Lovaň, Miláno, Bordeaux).

Témata jejich výzkumných prací prošla také vývojem, a to od výzkumu osobnosti sportovce přes výzkum osobností učitelů a jejich profesionální přípravy v kinantropologických oborech, zabývala se jejich činností při práci se žáky i uplatněním absolventů studia v praxi. V současné době se věnuje zejména teorii aplikovaných pohybových aktivit. V letech 1991–2000 byla řešitelkou 16 výzkumných a rozvojových projektů, které každoročně přinášely fakultě téměř jeden milion korun. Zanedbatelné nejsou ani její mezinárodní aktivity. Je na FTK UP garantkou evropského programu univerzitní spolupráce Socrates/Erasmus a koordinátorkou sítě univerzit středoevropských zemí programu CEEPUS. Nelze opomenout ani její členství v celé řadě prestižních společností. Je členkou Českomoravské psychologické společnosti, České ki-



nantropologické společnosti, Českého hnutí speciálních olympiád (ředitelka programu pro vzdělávání a výzkum), Evropské a Světové federace sportovní psychologie (FEPSAC, ISSP), Special Olympics International a dalších mezinárodních organizací.

Na profesorce Válkové je třeba ocenit zvláště její vitalitu, píli a činorodost. I když v letošním roce dovrší

své šedesátiny, zůstává stále mladá, plná životního optimismu a elánu.

Přejeme paní děkance k jejímu významnému životnímu jubileu pevné zdraví, osobní pohodu, ale zvláště pak hodně dalších pracovních úspěchů, které jistě přispějí k rozvoji celé fakulty a budou ku prospěchu jejích studentů, učitelů i zaměstnanců.



## THE RELATIONSHIP BETWEEN CHILDREN'S PERSONAL TRAITS, MOTOR ACTIVITY AND MOTOR PERFORMANCE

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Submitted in November, 2002

The aim of this study was to verify the presumption that sport activity and the motor performance of children is influenced by their temperament to a certain level. We examined 903 children (447 boys and 456 girls) from Slovak primary and secondary schools. Information about the personal features of children and their sport activities were received from the children themselves as well as from their parents by means of a questionnaire. The level of motor performance was assessed by a battery of 7 tests. According to the test results, the children were sorted into three groups; average, above average and below average. The relationship between temperament, sport activities and motor performance is assessed on the basis of  $\chi^2$  and coefficient of contingency C. There are no proven significant relationships between temperament and the sport activities of either boys and girls. However, the temperament of boys and girls is closely linked with their motor performance ( $\chi^2 = 14,3 > p_{0,05}$  C = 0,176;  $\chi^2 = 15,6 > p_{0,05}$  C = 0,184). Sanguine and choleric types show a more above-average level of motor performance in comparison to melancholic and phlegmatic types. Children qualified as melancholic and phlegmatic are more in the zone of under-average level than the other types. There are not remarkable differences concerning age.

*Keywords: temperament, sport activity, motor performance, children, youth.*

### INTRODUCTION

Determination of the psychological nature of sports activity and performance, as well as criteria on the basis of which a relation to further growth of sports performance and top sports achievements may be proven is of considerable importance for an effective selection of individuals for sports.

Within the framework of researching the given issue, many authors have searched for personal traits by which individuals going in for sports or reaching high sports results differ from the normal population or from less successful athletes, or for indicators preventing successful sports self-realisation, with the help of various psycho-diagnostic means (Berger & Littelfield, 1971; Bruner, 1969; Cooper, 1971; Gregor, 1996; Kodým, 1975; Kovač & Strel, 2000; Macák & Hošek, 1987; Smojver-Ažić, Andelić-Breš, & Donlic, 2002; Suchomel, 2002; Vaněk, Hošek, & Svoboda, 1974; Votík & Pruner, 1987).

Appropriate attention has also been paid to the field of temperament, namely for the reason that temperament is fairly genetically determined, relatively steady and less subject to the effects of intentional influence than any other personal characteristics. Our research has demonstrated that from the viewpoint of individual temperament, there are only very small differences between the populations going in and not going in for sports, between successful and less successful athletes, and on the other hand, considerable

differences between athletes engaged in the same sports event. It has not been confirmed, however, that certain individuals with selected temperament traits would be grouped in certain sports events (such as team sports games or endurance sports events) (Lokša, 1983; Petrovič, 1990; Řehulková, Fraňková, & Osecká, 1995; Vaněk, Hošek, & Svoboda, 1974; Votík & Pruner, 1987).

In connection with the issue of psychological contingency of motor activity and performance, interesting are the works searching for childhood personal traits of successful athletes (Godin & Shepard, 1986; Kodým, 1975). Findings indicate that successful athletes were more active, efficient and looking for motor activities at an early age than other children. A certain connection to those findings was also found by researching motor activity and performance in hyperactive (impulsive, hot-tempered, lively), normally active (calm, level-headed and quiet) and hypoactive (quiet to still) children (Medeková & Havlíček, 1996). It appears that hyperactive children are more often looking for motor activities and dispose of a higher level of motor performance than normally active and hypoactive children.

So research indicates that the psychological nature of motor and sports activities and the level of performance cannot be solved on the level of athletes reaching a certain level of performance only, but that attention should also be paid to the entire population of children and youth. On the basis of the above, this study

aims at an explanation of the relationship between the temperament of boys and girls aged 7, 11 and 15, their engagement in motor or sports activities, as well as their motor performance.

## **HYPOTHESIS**

A strong positive relationship between temperament traits and motor activity and performance cannot be unanimously assumed. A certain difference in respect to top or competitive sports people and the normal population may be assumed on the basis of existing empirical information. On the level of top and competitive sport, the observed relation is significantly affected by selection based on motor assumptions, and by an intentionally oriented sports practice. The motor performance of this population appears to be more spontaneous, depending on a whole range of needs, assumptions and personal characteristics, including temper. Early motor activity is mainly determined by temperament, by which the level of motor performance is also affected.

On the basis of the above, we assume that temperament traits of boys and girls have a relationship to their engagement in sports activities, but are, however, unrelated to the level of motor performance. From the viewpoint of age, closer connections were assumed in children aged 7 and 11 than at the age of 15.

## **SUBJECTS AND METHODS**

The observation took place of a sample of 903 children (447 boys and 456 girls) aged 7, 11 and 15 from 8 primary and 8 secondary randomly selected Slovak schools. The given sample comprised 139 boys and 143 girls aged 7, 166 boys and 168 girls aged 11, and 142 boys and 145 girls aged 15.

Personal traits of children were assessed with the help of a questionnaire where children's parents had to choose from a list of personal characteristics those most characteristic of their child. The selection of characteristics was based on Eysenck's Personality Inventory (EPI). Questions were characteristic of individual types of temperament. Parents had to respond whether their child appears to be mostly:

- 1 – sensitive, scrupulous, reserved, quiet, less sociable, pessimistic,
- 2 – deliberate, level-headed, patient, consistent, reliable, calm, rather passive,
- 3 – agile, lively, free and easy, carefree, open, available, sociable,
- 4 – explosive, active, optimistic, restless, impulsive.

1 being characteristic of melancholic, 2 of phlegmatic, 3 of sanguine and 4 of choleric tempers.

The character of motor or sports activities was determined on the basis of a questionnaire. Children – those younger helped by their parents – stated whether they go in for organised sports (in circles, clubs and groups), leisure sports (non-organised) or do not go in for sports at all.

Motor activity was assessed with the help of a battery of 7 tests: 50 m run, standing long jump, medicine ball throw, 1 minute sit-ups, pull-ups (11- and 15-year old boys), bent arm hang (7-year old boys and girls of all age categories), run to numbered balls and Cooper test.

Empirical data were assessed by means of mathematical statistics methods. The individual test performances of probationers were separately converted to Z-score in relation to the average performance of their age and sex groups. On the basis of the Z-score summary, individuals were classified into three zones of motor performance within their categories – average ( $\bar{x} \pm 0.5$  s), above average ( $\bar{x} + 0.5$  s and more) and below average ( $\bar{x} - 0.5$  s and less). In order to process the results of the whole sample of boys or girls, results of individuals, which had been classified into one motor performance zone from all three age categories, were merged. The relation between temperament traits on one hand and the level of motor performance and sports activity on the other was assessed by means of  $\chi^2$ -test and coefficient of contingency C. Statistical significance was decided at a 1% and 5% level of significance.

## **RESULTS AND DISCUSSION**

### **Motor performance**

As for boys, it is clear that there are certain variations between the percentage representation of individual age groups in individual motor performance zones, namely in the above-average and average ones, but they are rather insignificant. The above-average performance zone comprised 28–34 % of boys, the average performance zone 37–45 % of probationers and the below-average performance zone 26–29 % of boys. The performance of 7- and 11-year old boys is rather similar – their percentage of representation in above-average, average and below-average zones is about the same. The representation of 15-year old boys in performance zones appears to be more balanced. The classification of girls into performance zones seems relatively balanced. The above-average performance zone comprised 21 to 33 %; average performance was reached by 36–41 % of girls and below average by 30–31 %. With respect to the whole sample, the situations of boys and girls were similar. 31 % of boys and girls classified into the above-average motor performance zone, 41 % of boys and 38 % of girls into the average motor performance zone and 28 % of boys and 31 % of girls into the below-average motor performance zone (TABLE 1).

### **Motor and sports activities**

In respect of children's motor and sports activities (TABLE 2), organised sports activities are mostly participated in by 11- and 15-year old boys (more than 60 %), while the number of boys going in for leisure sports is nearly half of that (about 25–30 %). We have recorded a relatively low occurrence of individuals not

going in for sports at all (12, or 10 %). The engagement of 7-year old boys in organised and leisure sports activities is about the same (about 40 %), but the number of individuals not going in for sports at all is relatively high (17 %). We have found nearly the same engagement in organised and leisure sports activities in 7- and 11-year old girls (34–40 %), as well as an alarming percentage of girls not going in for sports at all (26–29 %). Girls 15 years of age go in more for leisure than organised sports (43–50 %), and only 8% of them do not go in for sports at all, which is a rather pleasant finding.

### Temperament traits

Parents' opinions on the temperament traits of their sons and daughters (TABLE 3) show that most parents assess their children of all age categories as sanguine (44–62 %), relatively less as phlegmatic (15–38 %) and choleric (8–18 %) and the least as melancholic (6–13 %). The number of sanguine boys and girls falls and the number of phlegmatic ones grows with age, generally reflecting the fact that briskness and impulsiveness are the basic temperament characteristics of children and their real temperament starts to appear only later. Shifts between age groups concerning emotionally labile types, such as melancholic and choleric, are not so remarkable.

### The relationship between sports activities and temperament traits of children

As for engagement in motor activities, temperament traits of boys (TABLE 4) were not crucial from the aspect of both individual age categories (7-year olds  $\chi^2 = 7.66 < p_{0.05}$   $C = 0.232$ ; 11-year olds  $\chi^2 = 6.96 < p_{0.05}$   $C = 0.202$ ; 15-year olds  $\chi^2 = 5.10 < p_{0.05}$   $C = 0.181$ ) and the entire sample ( $\chi^2 = 2.05 < p_{0.05}$   $C = 0.068$ ). Except for 7-year olds, all the other boys have gone in mostly for organised sports, regardless of their temperament; the highest number of boys not going in for sports at all was found among boys who may be characterised as melancholic. The highest number of 7-year old boys going in for sports was found among melancholic boys (98 %) and most boys not going in for sports at all were phlegmatic (24 %). Sanguine and choleric 7-year old boys have gone in mostly for non-organised sports and in this group, also a relatively high number of boys not going in for sports at all was found (18 %). Results obtained in the group of 7-year old boys were notable, but in general, they have not supported findings that impulsive, restless, lively and explosive (hyperactive) children are looking for motor activities more often than their mates (Medeková & Havlíček, 1996). This tendency, however, is rather characteristic of 11- and 15-year olds, as well as of the entire sample.

A similar situation was also found in girls (TABLE 5). No connection between the temperament and the character of motor activity has been confirmed in any age category (7-year olds  $\chi^2 = 5.51 < p_{0.05}$   $C = 0.197$ ; 11-year olds  $\chi^2 = 5.97 < p_{0.05}$   $C =$

$= 0.188$ ; 15-year olds  $\chi^2 = 5.92 < p_{0.05}$   $C = 0.198$ ) nor in the sample as a whole ( $\chi^2 = 6.32 < p_{0.05}$   $C = 0.118$ ). Contrary to boys, most girls of all age groups going in for organised sports may be characterised as sanguine and choleric (39–55 %). Girls, which may be characterised as melancholic and phlegmatic, have gone in more for leisure sports (28–57 %), or have not gone in for sports at all (36 % of 7-year olds). A similar situation has been determined also from the viewpoint of the entire sample of girls.

The assumption that temperament traits of boys and girls significantly depend on their engagement in motor and sports activities has not been confirmed. In this sense, the assumed higher spontaneous motor activity in younger, i. e. 7- and 11-year old children in comparison to 15-year olds has not been confirmed.

### Relation between temperament traits and motor performance

In respect of individual age categories, the observed relation in boys is statistically insignificant and contingency coefficients  $C$  refer to its low closeness (7-year olds  $\chi^2 = 7.66 < p_{0.05}$   $C = 0.232$ ; 11-year olds  $\chi^2 = 6.96 < p_{0.05}$   $C = 0.202$ ; 15-year olds  $\chi^2 = 5.10 < p_{0.05}$   $C = 0.181$ ). In spite of this insignificant and vague relation, however, it is for sure that the above-average motor performance level has been achieved by a relatively higher number of sanguine and choleric children of all age groups (29–44 %) and the below-average performance zone by the relatively highest number of melancholic children (42–50 %). In the zone of average performance, the representation of individual types is relatively proportionate (TABLE 6). The same also applies to the entire sample of boys, save that the observed relation is statistically important, however, rather vague again ( $\chi^2 = 14.3 > p_{0.05}$   $C = 0.176$ ).

Statistically important, however, is the rather vague relation between the temperament and the level of motor performance (TABLE 7) which has been determined in the category of 7-year old girls ( $\chi^2 = 14.3 > p_{0.05}$   $C = 0.305$ ), while the observed relation in 11- and 15-year old girls ( $\chi^2 = 6.39 < p_{0.05}$   $C = 0.197$ ;  $\chi^2 = 5.52 < p_{0.05}$   $C = 0.192$ ) is statistically insignificant. As well as boys, also girls have shown a certain tendency that the above-average motor performance zone is reached by a relatively higher number of sanguine and choleric (32–45 %) than melancholic and phlegmatic girls (8–26 %) save for 7-year olds, and on the other hand, the below-average motor performance zone is reached by the relatively highest number of melancholic girls (28–56 %). As to the entire samples of girls and boys, the relation between the temperament and the level of motor performance is statistically significant, however, rather vague ( $\chi^2 = 15.6 > p_{0.05}$   $C = 0.184$ ). There is also a tendency to a relatively higher occurrence of sanguine and choleric girls than melancholic and phlegmatic ones. The last mentioned tempers were mostly found in the below-average motor performance zone. The representation of

individual temperament types in the average motor performance zone is relatively proportionate.

The achieved results are partly singular, as the higher level of motor performance has not been supported by any significant engagement in either organised or leisure motor activities, while the below-average motor performance is not always the result of the lower level of motor activity. Regarding, however, the fact that in case of motor activities, the assumption that choleric and sanguine children go in for sports more often than melancholic and phlegmatic ones, and that the relatively highest number of children not going in for sports at all is found among melancholic ones, it may be considered that a higher level of motor performance is connected with a higher need of motor activity and its satisfaction, which has also been supported by findings of other authors (Godin & Shepard, 1986; Kodým, 1975; Medeková & Havlíček, 1996). In this connection, it would be interesting to assess the motor performance history of probationers. It would probably help us to better clarify the observed relation.

The assumed connection between the temperament and motor performance and its higher intensity at a younger age has been confirmed only in part. Though connections in certain observed cases are statistically important, they are rather vague and moreover, little supported by a higher or lower level of motor activity.

## CONCLUSIONS

1. The engagement of children and youth in motor and sports activities is not specially connected with their temperament characteristics. Lively, explosive, impulsive (sanguine and choleric) children and youth do not go in for sports significantly more often than calm, level-headed and introvert children (phlegmatic and melancholic). Neither has the higher spontaneity of motor expression at an early age been confirmed.
2. The level of motor performance is only partially connected with temperament traits. In general, sanguine and choleric children and youth reach a higher level of motor performance more often than their phlegmatic and melancholic mates, while melancholic and phlegmatic children and youth are more often found among individuals with below-average motor performance than choleric and sanguine types. Age individualities of the given relation have not been satisfactorily proven.
3. The direct usability of results for the selection of children for sports is rather limited. It has only been proven that initial selection should be oriented more to sanguine and choleric children. However, other temperament types can in no case be excluded. Another practical implication of results is that they point to groups hazardous from the aspect of motor activity and performance, to which increased attention should be paid.

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**VZTAH MEZI TEMPERAMENTOVÝMI  
CHARAKTERISTIKAMI DĚTÍ, JEJICH  
POHYBOVOU AKTIVITOU A ÚROVNÍ JEJICH  
POHYBOVÉ VÝKONNOSTI**  
(Souhrn anglického textu)

Cílem studie bylo ověřit předpoklad, že sportovní aktivita a motorická výkonnost dětí jsou do určité míry ovlivněny vlastnostmi jejich temperamentu. Do výzkumu bylo zahrnuto 903 dětí (447 chlapců a 456 děvčat) ze slovenských základních a středních škol. Údaje o sportovní aktivitě dětí a o jejich temperamentu byly zjišťovány dotazníkem. Děti (mladší ve spolupráci s rodiči) udávaly, zda sportují organizovaně, rekreačně anebo nesportují. Rodiče vybírali z předložených souborů vlastností ten, který nejvíce charakterizoval

jejich dítě. Úroveň pohybové výkonnosti byla hodnocena pomocí 7složkové testové baterie. Na základě výsledků testování byly děti zařazeny do tří výkonnostních pásem: nadprůměrného, průměrného a podprůměrného. Vztahy mezi temperamentem, úrovní sportovní aktivity a pohybové výkonnosti jsme hodnotili pomocí  $\chi^2$  testu a koeficientu kontingence C. Souvislost mezi typem temperamentu a zapojením do sportovní, resp. pohybové aktivity se u chlapců ani u děvčat nepotvrdila. Typ temperamentu chlapců a dívek však v určitém věku vykazoval těsnou souvislost s úrovní jejich motorické výkonnosti ( $(C^2 = 14,03 > p_{0,05}; C = 0,176; C^2 = 15,06 > p_{0,05}; C = 0,184)$ ). Sangvinické a cholerické děti (chlapci i děvčata) dosahovaly ve vyšší míře nadprůměrnou úroveň výkonnosti ve srovnání s dětmi melancholickými a flegmatickými. Melancholické a flegmatické děti (chlapci i děvčata) se naopak ve vyšší míře nacházeli v podprůměrném pásmu výkonnosti než děti sangvinické a cholerické. Z hlediska věku neexistují v tomto vztahu statisticky významné odlišnosti.

*Klíčová slova: temperament, sportovní aktivita, pohybová výkonnost, děti, mládež.*

**TABLE 1**

Relative representation of boys and girls in motor performance zones (%)

	Boys			Girls		
	Above-average	Average	Below-average	Above-average	Average	Below-average
<b>7 years</b>	32	42	26	29	41	30
<b>11 years</b>	28	45	27	31	38	31
<b>15 years</b>	34	37	29	33	36	31
<b>All</b>	31	41	28	31	38	31

**TABLE 2**

Relative representation of boys and girls in kinds of sports activities (%)

	Boys			Girls		
	Organised sport	Spontaneous activity	Non-sporting	Organised	Spontaneous activity	Non-sporting
7 years	41	42	17	40	34	26
11 years	64	24	12	36	35	29
15 years	61	29	10	42	50	8
All	55	32	13	39	40	21

**TABLE 3**

Relative representation of children in temperament types (%)

	Boys				Girls			
	Melancholic	Phlegmatic	Sanguine	Choleric	Melancholic	Phlegmatic	Sanguine	Choleric
7 years	9	15	60	12	9	18	62	8
11 years	11	16	54	18	8	16	61	12
15 years	6	38	44	11	6	34	47	13
All	9	23	54	14	8	23	58	11

**TABLE 4**

Relationship between the temperament and motor activity – boys

Age	Sporting activity	Temperament				$C^2/C$
		Melancholic (%)	Phlegmatic (%)	Sanguine (%)	Choleric (%)	
7 years	Organised	42	57	40	23	$C^2 = 7,66$ $C = 0,232$
	Spontaneous	50	19	42	59	
	Non-sporting	8	24	18	18	
11 years	Organised	45	58	64	79	$C^2 = 6,96$ $C = 0,202$
	Spontaneous	33	31	25	14	
	Non-sporting	22	11	11	7	
15 years	Organised	62	59	65	44	$C^2 = 5,10$ $C = 0,181$
	Spontaneous	13	32	25	44	
	Non-sporting	25	9	10	12	
All	Organised	47	58	56	55	$C^2 = 2,05$ $C = 0,068$
	Spontaneous	34	29	31	34	
	Non-sporting	18	13	13	11	



**TABLE 5**

Relationship between the temperament and motor activity – girls

Age	Sporting activity	Temperament				$C^2/C$
		Melancholic (%)	Phlegmatic (%)	Sanguine (%)	Choleric (%)	
7 years	Organised	31	24	44	55	$C^2 = 5,51$ $C = 0,197$
	Spontaneous	46	40	30	27	
	Non-sporting	23	36	26	18	
11 years	Organised	36	30	39	40	$C^2 = 5,97$ $C = 0,188$
	Spontaneous	28	26	34	45	
	Non-sporting	36	44	27	15	
15 years	Organised	44	35	50	53	$C^2 = 5,92$ $C = 0,198$
	Spontaneous	44	57	50	32	
	Non-sporting	12	8	4	15	
All	Organised	36	31	43	48	$C^2 = 6,32$ $C = 0,118$
	Spontaneous	39	44	37	36	
	Non-sporting	25	25	20	16	

**TABLE 6**

Relationship between the temperament and motor performance – boys

Age	Motor performance	Temperament				$C^2/C$
		Melancholic (%)	Phlegmatic (%)	Sanguine (%)	Choleric (%)	
7 years	Above-average	16	33	36	29	$C^2 = 4,07$ $C = 0,172$
	Average	42	48	42	35	
	Below-average	42	19	22	35	
11 years	Above-average	11	23	31	38	$C^2 = 8,84$ $C = 0,227$
	Average	39	42	47	41	
	Below-average	50	35	27	21	
15 years	Above-average	12	33	37	44	$C^2 = 4,97$ $C = 0,185$
	Average	38	35	41	25	
	Below-average	50	32	22	31	
All	Above-average	13	30	34	37	$C^2 = 14,03^*$ $C = 0,176$
	Average	40	34	44	36	
	Below-average	47	37	22	27	

\* 5 % level of significance

**TABLE 7**

Relationship between the temperament and motor performance – girls

Age	Motor Performance	Temperament				$C^2/C$
		Melancholic (%)	Phlegmatic (%)	Sanguine (%)	Choleric (%)	
7 years	Above-average	8	24	39	10	$C^2 = 14,1^*$ $C = 0,305$
	Average	31	40	40	45	
	Below-average	61	36	21	45	
11 years	Above-average	28	19	32	45	$C^2 = 6,39$ $C = 0,197$
	Average	36	33	40	30	
	Below-average	36	48	27	25	
15 years	Above-average	22	26	37	42	$C^2 = 5,52$ $C = 0,192$
	Average	22	37	37	37	
	Below-average	56	37	26	21	
All	Above-average	20	24	36	36	$C^2 = 15,6^*$ $C = 0,184$
	Average	30	37	39	36	
	Below-average	50	40	25	28	

\* 5 % level of significance

## BASIC KINEMATIC DIFFERENCES BETWEEN TWO TYPES OF JUMP SHOT TECHNIQUES IN HANDBALL

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The aim of this study is to identify differences in some basic kinematic parameters between two different jump shot (JS) techniques used in handball. Ten male top-level handball players executed six JS (three shots using each technique). Among all attempts, we chose two JS for all players, the most characteristic for each technique, for further analysis. Two SVHS Video cameras operating at 25 frames per second were used for the acquisition of the data. Data processing was performed by APAS (Ariel Performance Analyses System). Basic statistics for variables were computed, and the t-test for paired samples was used to assess statistical significance differences between kinematic variables. Many similarities and differences between both shots were found. Most interesting are the following characteristics: almost all parameters of approach show that the efficiency of the approach in the last step was better in jump shots where the take-off leg is opposite the throwing hand (JS1); the body centre of gravity in JS2 (the take-off leg is on the same side as the hand with which the players are shooting) before the throw moved forward significantly more than the body centre of gravity by JS1; in JS1 the height of the throw was significantly greater than in JS2; the angle between the shoulder axis and the horizontal axis in the sagittal plane at the end of the take-off was significantly greater in JS1. The angle in the hip axis was significantly greater in JS2; landing in JS1 was mostly made with the take-off leg (left leg) while in JS2 it was made with the opposite leg (left leg).

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*Keywords: kinematic, handball, jump shot.*

### INTRODUCTION

All activities in handball are performed under specific conditions, in the presence of players of the opposing team and while observing playing regulations. Their selection and execution therefore depends mostly on situations coming up during the match. Even if a player can execute the individual elements sometimes in a non-typical way, certain kinematic parameters do exist for most elements that show the greater or lesser efficiency of the element's execution.

The jump shot technique is the most typical one among various shooting techniques used in handball. Usually the jump shot take-off is from the leg which is opposite the throwing hand (JS1 – right handers use the left leg for take-off). In this case the player gains the correct natural co-ordination which allows for a successful – forceful and accurate – shot towards the goal. But during the game we can also see playing situations where the players are forced to perform the jump shot after take-off with the leg on the same side as the hand with which they are shooting (JS2). This kind of jump shot is more complex and demands well developed inter- and intra muscular co-ordination. The aim of this study is to identify differences in some basic kinematic parameters between the above mentioned two jump shot techniques, thus providing data that can be used as guidelines in everyday practice.

The key characteristics, which are stressed as their findings by most authors studying the bio-mechanical characteristics of throws in handball (Küster, 1973; Kastner, Pollany, & Sobotka, 1978; Olberg, 1979; Zvonarek & Hraski, 1996; Zahalka, Tuma, & Bunc, 1997; Bon, Šibila, & Erčulj, 1997; Šibila & Bon, 1999; Šibila, Bon, & Štuhec, 1999; Taborsky, Tuma, & Zahalka, 1999) are as follows:

- The correct order of recruitment of the individual parts of the body is important, allowing the development of maximal velocity and control of these parts – this order is from the proximal (central) parts to the distal (distant) parts of the body. The most proximal part begins the action, it is then followed by the next, and so on till the most distal part – the wrist or the palm. The velocity of movement of the smaller and lighter parts of the body with lesser inertia is added to the velocity of the bigger ones, achieving the greatest possible velocity at the end part of the kinematic chain (each proximal part offers support for the next, more distal part). The increase of angular velocity of the individual segment of the kinematic chain is connected to the stoppage of the proximal part (the angular velocity of the elbow is greater after stopping the movement of the shoulder, of the wrist after stopping the elbow, etc).

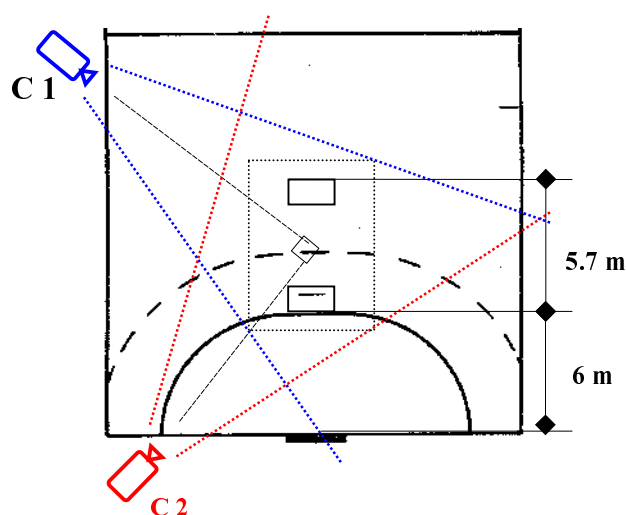
- It is very important to take into account in these shots the certain physiological characteristics of muscular effort and try to perform the shot with an excentric-concentric type of muscular effort, since it is more appropriate in the production of greater force. Therefore, at least for some muscular groups (or muscles involved in the shot) there should be the shortest possible time between extension and contraction. Electromyographic measurements showed that (under ideal conditions) agonistic muscles are completely contracted till the time of maximal velocity of the individual link in the kinematic (throwing) chain and then completely relax with a maximal recruitment of antagonists (Müller, 1982). It is important to stress that extensors in the wrists of worse players participate much less in the wrist part of the shot than those of better players. The delaying effect of the antagonistic (opposite) muscles is obviously not completely utilised in this case.

## METHODS

Ten male top-level handball players (average height (mean  $\pm$  s) =  $191.1 \pm 4.48$  cm, average body mass (mean  $\pm$  s) =  $90.0 \pm 4.40$  kg, average age (mean  $\pm$  s) =  $23.4 \pm 4.2$  years) executed, after 20 minutes of warming-up, six jump shots. They used two different techniques (three shots each). First they chose a starting position for approach in the middle of the playing court. Their approach consisted of two parts. First they did three steps, bounced the ball and after that performed three steps of approach. They performed take-off in an area that was marked on the free-throw

line. They performed all the shots with maximal effort towards the goal. From all the attempts, we chose two jump shots for all players for further analysis. Two SVHS Video cameras operating at 25 frames per second were used for acquisition of the data. The cameras were positioned in such a way that, after the registration of eight points, a reference frame ( $500 \text{ cm} \times 100 \text{ cm} \times 100 \text{ cm}$ ) allowed analyses in 3D space. Data processing was performed by APAS (Ariel Performance Analysis System). A fifteen segment model of the human body was defined by digitised co-ordinates of 16 reference points. Reference points represented joint centres of limbs on both sides of the body and additionally atlas, vertex and the ball. The centre of body gravity (CG) was calculated from Dempster's

**Fig. 1**  
Scheme of the measurement experiment



**TABLE 1**  
Parameters of approach

	$\bar{x}$	s	$s_{\bar{x}}$	min	max	t	sig.t
1. Vertical change of CG height in the last step (cm)							
<i>JS1</i>	-1.60	0.65	0.21	-2.40	-0.80	13.85	0.000**
<i>JS2</i>	-2.97	0.70	0.22	-3.90	-1.80		
2. Decrease of horizontal CG velocity in the last step ( $\text{m} \cdot \text{s}^{-1}$ )							
<i>JS1</i>	-1.43	0.19	0.61	-1.82	-1.20	5.49	0.000**
<i>JS2</i>	-1.75	0.26	0.81	-2.12	-1.42		
3. Increase of vertical CG velocity in the last step ( $\text{m} \cdot \text{s}^{-1}$ )							
<i>JS1</i>	1.79	0.29	0.09	-2.40	-0.80	2.43	0.038*
<i>JS2</i>	1.58	0.39	0.12	2.43	0.04		
4. Horizontal velocity of CG at the end of the last step ( $\text{m} \cdot \text{s}^{-1}$ )							
<i>JS1</i>	4.51	0.20	0.06	4.20	4.94	2.41	0.039*
<i>JS2</i>	4.18	0.50	0.16	3.61	5.08		
5. Vertical velocity of CG at the end of the last step ( $\text{m} \cdot \text{s}^{-1}$ )							
<i>JS1</i>	-0.23	0.24	0.07	-0.55	0.29	1.32	0.220
<i>JS2</i>	-0.34	0.27	0.08	-0.85	-0.06		

Legend:

$\bar{x}$  – mean, s – standard deviation,  $s_{\bar{x}}$  – standard error of the mean, min – minimum value, max – maximum value, t – value of t-test, sig.t – significance of t-test.

\* – significance level  $\alpha < .05$ , \*\* – significance level  $\alpha < .01$

using Miller and Nelson's anthropometrical model (by Winter, 1990). The SPSS statistical package was used for statistical data analyses. Basic statistics for variables were computed. The t-test for paired samples was used to assess the statistical significance of the differences between kinematic variables. Statistical significance was set at  $\alpha < .01$  or at  $\alpha < .05$ . In the text, data are reported as mean  $\pm$  standard deviation.

## RESULTS AND DISCUSSION

According to its basic structure, the jump shot was divided into five phases: approach, take-off, flight, throw and landing. We chose 31 parameters which represent the basic kinematic structure of jump shots in all the phases.

### Approach

In this study we took into consideration only the last step of the approach. This means the time from the moment when the swinging leg leaves the ground to the moment when the take-off leg comes into contact with the ground.

The main goal of approach in handball jump shots is the achievement of optimal conditions (or starting point) for the realisation of the other phases. In JS1 the vertical height of the body centre of gravity in the last step decreased by  $1.60 \pm 0.65$  cm and in JS2 by  $2.97 \pm 0.70$  cm. The difference is statistically significant (sig.t = 0.000). Players use the last step of the approach for preparing for the transformation of horizontal into vertical impulse, however it seems that in the case of JS2 this was done by greater step lengthening. The decrease in horizontal velocity was also sig-

nificantly greater in the case of JS2 (sig.t = 0.000). However, the increase in vertical velocity was statistically significantly greater in JS1 (sig.t = 0.038). The value of horizontal velocity at the end of the last step of approach was significantly greater in JS1 (sig.t = 0.039), while no significant difference was found in vertical velocity at the same moment.

### Take-off

This phase is the interval from the beginning to the end of the contact with the ground of the take-off leg in the last step of approach. In this phase, a decrease in horizontal velocity and increase in vertical velocity is taking place simultaneously. The decrease in horizontal velocity during take-off was significantly greater in JS2 (sig.t = 0.000). The increase in vertical velocity was also greater in JS2, but not significantly (sig.t = 0.188). However, the duration of take-off contact was significant (sig.t = 0.002) shorter in JS2. The angle between the centre of gravity and the contact leg at the end of the take-off (push-off angle) was significantly greater in JS2 (sig.t = 0.000). This produced a lesser vertical and a greater horizontal component of velocity of the body centre of gravity in JS1 compared to JS2. Other important parameters were the angles between the shoulders or hip axis and horizontal axis on a sagittal plane at the end of take-off. At that moment, the angle of the shoulder axis was significantly greater in JS2 (sig.t = 0.000). This is fully in accordance with the description of technique of both jump shots (Jankelić, 1973). In JS1, players namely executed a back swing (so-called circle- or semi-circle back swing) with the throwing arm during the last step of the approach, so that at the end of the take-off they

**TABLE 2**  
Parameters of take-off

	$\bar{x}$	S	$s_{\bar{x}}$	min	max	t	sig.t
1. Decrease of horizontal velocity ( $m \cdot s^{-1}$ )							
<i>JS1</i>	-0.78	0.06	0.02	-0.87	-0.69	4.75	0.001**
<i>JS2</i>	-1.30	0.33	0.12	-1.73	-0.52		
2. Increase of vertical velocity ( $m \cdot s^{-1}$ )							
<i>JS1</i>	1.36	0.04	0.01	1.31	1.42	-1.43	0.188
<i>JS2</i>	1.52	0.37	0.12	0.96	2.12		
3. Duration of take-off contact (s)							
<i>JS1</i>	0.258	0.02	0.05	0.24	0.28	4.47	0.002**
<i>JS2</i>	0.218	0.02	0.08	0.18	0.26		
4. Height of CG at the end of the take-off (cm)							
<i>JS1</i>	133	6.94	2.19	124	143	1.15	0.282
<i>JS2</i>	130	3.47	1.10	124	137		
5. Angle between CG and contact leg at the end of the take-off (°)							
<i>JS1</i>	56	4.12	1.30	52	72	-14.58	0.000**
<i>JS2</i>	84	5.23	1.65	64	91		
6. Angle in hip axis at the end of the take-off (°)							
<i>JS1</i>	109	14.59	4.61	90	112	-2.82	0.020*
<i>JS2</i>	125	12.99	4.11	112	148		
7. Angle in shoulder axis at the end of the take-off (°)							
<i>JS1</i>	153	14.50	4.59	128	171	14.11	0.000**
<i>JS2</i>	110	9.68	3.06	101	128		

can get into a good position for throwing with the opposite shoulder in the direction of shooting. In the case of JS2, this is impossible as the take-off leg and the throwing arm are on the same side. Because of this, players can start with the back swing (direct lifting of the hand up without circling – the so-called whip back swing) simultaneously with take-off. The difference between the angles in the hip axis was also statistically significant ( $\text{sig.t} = 0.020$ ), but greater values in this case were achieved in JS2. At first glance this is not fully logical, but if we take into consideration that in both cases players lift their swinging leg straight up (which is not completely in accordance with the description of the execution of JS1, while in this case players have to lift that leg up and back) (Jankelić, 1973). Such a way of lifting the swinging leg decreases the above mentioned angle in JS1 and increases it in JS2 – while in this case the swinging leg is on the same side as the throwing hand.

### Flight

Because the flight of the body (if air resistance is neglected) is determined by the characteristics of the parabola, the previously mentioned parameters, describing the horizontal and vertical take-off velocity, define the basic flight characteristics in both shots. Maximal height of the flight was higher in JS1, but the difference was not statistically significant ( $\text{sig.t} = 0.054$ ). During take-off, flight players help themselves to jump higher by swinging upwards with both hands and the swinging leg. This was done much more effectively in the case of JS1, due to a more natural coordination. The body centre of gravity in JS2 moved forward before the shot much more than the body centre of gravity in JS1 ( $\text{sig.t} = 0.013$ ). Duration of flight and the time taken to reach the maximum height of flight were about the same in both shots. This is also true for the greatest angle of the shoulder axis during the flight. It seems that in JS2, players can manage a good position for the throw with the opposite shoulder

directed towards the target during the flight – the difference is that in JS2 this is possible only during flight. As a consequence it's very difficult or even impossible for players to shoot in JS2 from a very high position and with more time for choosing the direction of the throw.

### Throw

In JS1, the average height of release ( $276 \pm 19.41$ ) was much higher than in JS2 ( $258 \pm 18.95$  cm) ( $\text{sig.t.} = 0.001$ ) in spite of the small difference in maximum body centre of gravity ( $174 \pm 9.22$  cm and  $168 \pm 8.99$  cm). Decrease in the maximum body centre of gravity height up till the throw was  $10 \pm 7.19$  cm in JS1 and  $29 \pm 13.57$  cm in JS2 ( $\text{sig.t} = 0.006$ ). Time from the take-off till the throw was also statistically significantly longer in JS2 than in JS1 ( $\text{sig.t} = 0.001$ ). This means that the throws from JS2 were executed just before landing. Beside this, the most interesting characteristics are those which describe the functioning of the kinematic chain: peak joint centre velocities, and, of course, the velocity of the ball throw. The functioning of the kinematic chain is based on energy transfer from the proximal segments of the body to the distal segments and then to the ball. Thus it was expected that peak joint velocity, relevant to the throwing movement, would increase and follow the same order: shoulder, elbow and wrist. This was the case in both analysed shots. In the throwing phase, the peak shoulder velocity after take-off was  $5.48 \pm 0.33$  in JS1 and  $5.53 \pm 0.44$  ms<sup>-1</sup> in JS2, elbow  $10.70 \pm 0.63$  ms<sup>-1</sup> in JS1 and  $10.04 \pm 1.53$  ms<sup>-1</sup> in JS2, and wrist  $13.55 \pm 0.69$  ms<sup>-1</sup> in JS1 and  $12.98 \pm 1.26$  ms<sup>-1</sup> in JS2. The differences in all these parameters were not significant. Accordingly, it could have been expected that peak joint velocities would be reached in the same orderly progression. The peak shoulder velocity had been achieved within  $0.31 \pm 0.07$  s after the take-off in JS1 and  $0.40 \pm 0.05$  s in JS2, elbow within  $0.33 \pm 0.07$  s in JS1 and  $0.42 \pm 0.06$  s in JS2, peak wrist velocity was

**TABLE 3**  
Parameters of flight

	$\bar{x}$	S	$s_{\bar{x}}$	min	max	t	sig.t
1. Maximal height of the flight (cm)							
JS1	174	9.22	2.91	156	187	2.21	.054
JS2	168	8.99	2.84	158	183		
2 Time for reaching the maximal height of flight (s)							
JS1	0.28	0.02	0.07	0.24	0.30	1.35	0.209
JS2	0.27	0.03	0.01	0.20	0.32		
3. Horizontal movement of CG till the moment of throw (cm)							
JS1	128	20.12	6.36	105	162	-3.11	0.013**
JS2	151	13.73	4.35	125	168		
4. Duration of flight (s)							
JS1	0.65	0.05	0.02	0.58	0.74	1.68	0.127
JS2	0.62	0.05	0.02	0.54	0.70		
5. The greatest angle in shoulder axis (°)							
JS1	170	6.00	1.90	159	177	1.42	0.189
JS2	168	6.69	2.11	155	173		

achieved within  $0.39 \pm 0.07$  s in JS1 and  $0.48 \pm 0.05$  s in JS2, while the ball was thrown within  $0.41 \pm 0.06$  s in JS1 and  $0.50 \pm 0.05$  s in JS2. The velocity of the ball moving towards the goal was  $24.14 \pm 1.29$  ms<sup>-1</sup> in JS1 and  $22.32 \pm 2.00$  ms<sup>-1</sup> in JS2 (sig.t = 0.006). This means that throwing efficiency was significantly greater in JS1 in spite of very similar data obtained for both JSs in many parameters relevant for the execu-

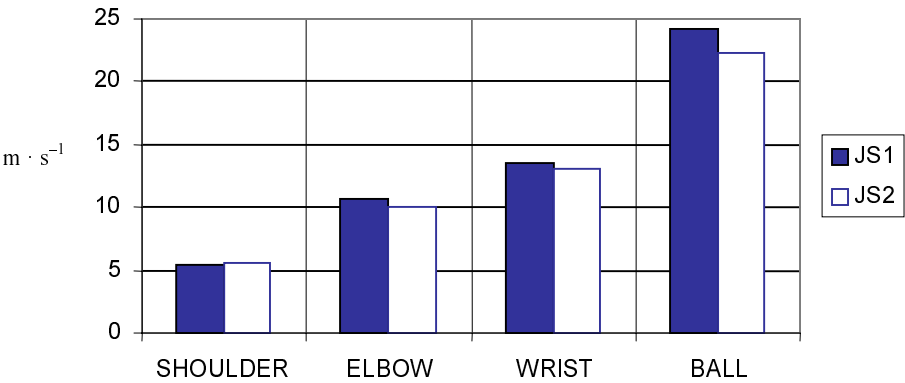
tion of the shot (for example peak velocities of the elbow, shoulder and wrist).

At the moment of throw, the angle in the shoulder axis was significantly greater in JS2 (sig.t = 0.005). The position of the shoulder axis is better in JS1 since it shows that the throwing arm can act longer on the ball. Perhaps it's one of the reasons why the peak velocity of the throw was higher in JS1 in spite of the

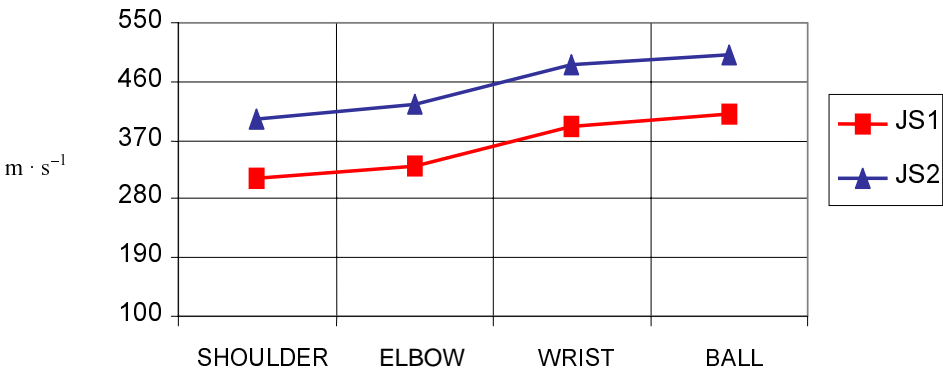
**TABLE 4**  
Parameters functioning in the kinematic chain

	PEAK JOINT CENTRES' VELOCITY		TIMING OF THE PEAK JOINT CENTRES' VELOCITY (after the take-off)	
	JS1	JS2	JS1	JS2
<i>Shoulder</i>	5.48 ms <sup>-1</sup>	5.53 ms <sup>-1</sup>	0.31 s	0.40 s
<i>Elbow</i>	10.70 ms <sup>-1</sup>	10.04 ms <sup>-1</sup>	0.33 s	0.42 s
<i>Wrist</i>	13.55 ms <sup>-1</sup>	12.98 ms <sup>-1</sup>	0.39 s	0.48 s
<i>Ball</i>	24.14 ms <sup>-1</sup>	22.32 ms <sup>-1</sup>	0.41 s	0.50 s

**Fig. 2**  
Peak joint centres' velocity



**Fig. 3**  
Timing of the peak joint centres' velocity



**TABLE 5**  
Parameters of throw

	$\bar{x}$	S	$s_{\bar{x}}$	min	max	t	sig.t
1. Height of throw (cm)							
JS1	276	19.41	16.14	243	308	4.98	0.001**
JS2	258	18.95	5.99	232	297		
2. Velocity of throw ( $m \cdot s^{-1}$ )							
JS1	24.14	1.29	0.41	21.34	25.50	3.53	0.006**
JS2	22.32	2.00	0.63	19.52	25.11		
3. Decrease of maximal CG height till the throw (cm)							
JS1	10	7.19	2.28	3	23	-4.64	0.001**
JS2	29	13.57	4.29	10	55		
4. Time from take-off till throw (s)							
JS1	0.41	0.07	0.02	0.32	0.52	-4.56	0.001**
JS2	0.50	0.05	0.01	0.44	0.60		
5. Peak velocity in wrist joint ( $m \cdot s^{-1}$ )							
JS1	13.55	0.69	0.22	12.71	14.84	1.57	0.151
JS2	12.98	1.26	0.38	10.86	14.96		
6. Time from take-off till peak velocity in wrist joint (s)							
JS1	0.392	0.08	0.02	0.28	0.52	-4.413	0.002**
JS2	0.486	0.05	0.02	0.44	0.60		
7. Peak velocity in elbow joint ( $m \cdot s^{-1}$ )							
JS1	10.70	0.63	0.20	9.73	12.16	1.23	0.249
JS2	10.04	1.53	0.48	7.63	12.43		
8. Time from take-off till peak velocity in the elbow joint (s)							
JS1	0.330	0.08	0.02	0.22	0.42	-5.111	0.001**
JS2	0.424	0.06	0.02	0.36	0.54		
9. Peak velocity in the shoulder joint ( $m \cdot s^{-1}$ )							
JS1	5.48	0.33	0.10	4.91	6.01	-0.270	0.793
JS2	5.53	0.44	0.14	4.98	6.17		
10. Time from take-off till peak velocity in the shoulder joint (s)							
JS1	0.310	0.07	0.02	0.20	0.42	-4.548	0.001**
JS2	0.404	0.05	0.02	0.32	0.50		
11. The angle of the hip axis at the moment of throw (°)							
JS1	83	11.29	3.57	64	97	-3.67	0.005**
JS2	99	9.90	3.13	73	108		
12. The angle of the shoulder axis at the moment of throw (°)							
JS1	54	15.77	4.99	28	82	-3.96	0.005**
JS2	72	16.06	5.08	43	100		

almost identical values reached in the shoulder, elbow and wrist joint peak velocities.

### Landing

After the ball had been thrown, the throwing arm continued to move forward and down in both JSs, while the whole body prepared for landing. In JS1 the first contact with the ground was mostly made with the take-off leg and in JS2 with the opposite leg (in both JSs some of the players landed with both legs simultaneously). That action was followed by the flexion of

the knee, thus absorbing the impact of the landing. The second leg absorbed over the rest of the impact and helped to maintain the balance of the body. The height of body centre of gravity at the moment of landing contact was significantly higher in JS1 (sig.t = 0.002). It's also in connection with the height of the throw. Since in JS1 the height of the throw was significantly higher, the players had more time to prepare themselves for landing. In JS2 the players performed the shot just before landing and such action demands that the landing is delayed as long as possible.

**TABLE 6**  
Parameter of landing

	$\bar{x}$	s	$s_{\bar{x}}$	min	max	t	sig.t
1. Height of CG at the moment of landing contact (cm)							
JS1	120	6.69	2.11	108	132	3.17	0.002**
JS2	108	10.26	3.24	94	121		



## CONCLUSION

In conclusion, both similarities and differences were found between shots. The most interesting are the following:

- The body centre of gravity before the throw in JS2 moved forward much more than the body centre of gravity in JS1.
- In JS1 the height of the throw was much greater than in JS2 in spite of the fact that the maximal body centre of gravity height during flight changed only half as much. This means that the throw in JS2 was executed just before landing.
- The angle between the shoulder axis and the horizontal axis in the sagittal plane at the end of take-off was significantly greater in JS1. The same angle in the hip axis was significantly greater in JS2. This is one of the most important differences between the JSs. It means that the position of the players at the end of take-off in JS2 was frontal and in JS1 sideways, in regard to the direction of approach. As a consequence, players are forced to perform a specific back swing with the throwing hand in JS2, while in JS1, players could make the back swing during the last step or even sooner. This is impossible in JS2. Therefore, in JS2 the players had to perform a so-called “whip” back swing by quickly lifting the hand up without circling. In most cases they started this action simultaneously with take-off and continued it during the flight. That is the reason why they performed their shots just before landing.
- Landings in JS1 were mostly made with the take-off leg (left leg) while in JS2 they were made with the opposite leg (right leg).

After detailed analyses of both JSs, playing situations in the game can be identified, where players can perform one or the other JS. JS1 is useful in almost all attack situations: as a shot from a distance, in a break through and in a fast break. We can say that it is the basic way of jump shooting and players have to try to use it as much as possible in all situations. The reason for that is that there is a better and easier exploitation of all motor abilities and morphologic characteristics of the players and consequently a more efficient execution: a greater height of the flight and velocity of the throw than in JS2.

But on the other hand, in JS2 also, almost all kinematic characteristics were very good. Some of them were as good as in JS1 or even better. This is surprising because of the very complex co-ordination demands if the player wants to perform this JS correctly with great force and accuracy. We can understand this better, if we know that almost all participants in this study were members of the junior or even the senior National Team. They were therefore well educated and trained. We speculate that the difference would be greater if we would have measured less experienced players. But in spite of the good results in many kin-

ematics parameters of JS2, it does have some peculiarities limiting the use of this JS in some playing situations in handball. First of all, it's a jump shot from a distance. Because of the specific back swing with the swinging hand (without swinging it during approach) players couldn't perform this JS as a JS from a distance. Our research shows that the throw in this JS could be executed only just before landing and from a low height. Such a way of shooting is inappropriate for shooting from a distance over the block of defence players. So JS2 could be very useful only when the players perform the shooting in a break through, in a fast break and from a wing or pivot position. Because of different reasons in such cases they couldn't always make their approach in such a way as to push off with the opposite leg (JS1) – especially in situations when they are too near to the line of the goalkeeper's area to take another step without danger of passing over. The second reason (tactic) for performing JS2 in such a situation is surprise for defence players (avoiding fouls) and especially for goalkeepers, who don't expect such an attack action.

For practice it is also very important that young players learn many different shooting techniques. It is important for co-ordination and also for tactical reasons. With JS2 shooting technique, players learn how to perform a specific back swing, which demands good exploitation of the muscle's elastic potential (they gain an adequate idea about inter- and intra-muscular co-ordination of the involved muscles). We speculate that this could have a good influence on improving inter- and intra-muscular co-ordination also in other shooting techniques. In our opinion, the muscles' actions in handball shots (we take into consideration particular shoulder and hand muscles used in the back swing and throw) is namely a typical example of a two-phase eccentric-concentric muscular contraction (Šibila & Bon, 1999).

From the tactical point of view, mastering this technique is important for young players, because it enables them to play in accordance with the game situation. They can therefore choose various appropriate techniques for different game situations. These statements are fully in harmonisation with experts' instructions for teaching and training young players.

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## ZÁKLADNÍ KINEMATICKÉ ROZDÍLY MEZI DVĚMA TECHNIKAMI STŘELBY Z VÝSKOKU V HÁZENÉ

(Souhrn anglického textu)

Cílem této studie je identifikovat rozdíly v některých základních kinematických parametrech mezi dvěma rozdílnými technikami střelby z výskoku (SV), které se používají v házené. Deset nejlepších házenkářů provedlo šest hodů z výskoku (každou technikou tři střely). Pro všechny hráče jsme pro další analýzu vybrali ze všech pokusů dvě nejtypičtější techniky střelby z výskoku. Pro pořízení dat byly použity dvě SVHS video kamery s rychlostí záznamu 25 obrázků za sekundu. Zpracování dat provedla společnost APAS (Ariel Performance Analyses System). Pro proměnné byly spočítány základní statistické údaje; pro párové ukázky byl použit t-test, aby se odhalily statisticky významné rozdíly mezi kinematickými proměnnými. Objevili jsme mnoho podobností i rozdílů mezi oběma střelami. Nejzajímavější jsou následující výsledky: téměř všechny parametry postoje ukazují, že efektivita postoje v posledním kroku byla lepší při SV, při kterém odrážející noha je opačná k házející ruce (SV1); těžiště těla při SV2 (odrážející noha je na stejné straně jako ruka, kterou hráči střílejí) se před hodem mnohem více pohne dopředu než při SV1; ve SV1 byla výška hodu významně větší než při SV2; úhel mezi ramenní osou a horizontální osou v sagitální rovině na konci odrazu byl významně větší než při SV1. Úhel mezi osou boku byl významně větší při SV2; dopad při SV1 byl častější na odrážející nohu (levá) zatímco při SV2 byl dopad na druhou nohu (pravou).

*Klíčová slova:* kinematický, házená, střelba z výskoku (SV).

## SPORT, MOTOR AND HIKING FREE TIME ACTIVITIES ACCORDING TO MOTIVATION FACTORS (DOWNHILL SKIING)

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In the last few years the proportion of demands on physical potential and potential of a mental or intellectual character has completely changed. The claims made on physical potential, except for some work activities in which claims on physical disponability dominate, are slowly decreasing. The basic level determined by work is spontaneously decreasing as well. Therefore it is necessary to replace this source with free time activities. The scale of motor and sport activities in the natural environment is wide and constantly growing both in offers "for everyone" and in extreme aspects, differentiating possibilities of realisation. One favourite is skiing: downhill and cross-country. In our study we analyse the determination of motor, sport and hiking free time activities in a natural environment according to motivation factors both generally and in the field related to orientation to downhill skiing.

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*Keywords: motor and sport activities in a natural environment, motivation, free time, downhill and cross-country skiing.*

### INTRODUCTION

In the last few years the proportion of demands on physical potential and potential of a mental or intellectual character has completely changed. The claims for physical potential, apart from some work activities which require physical disponibility, are slowly decreasing. The basic level determined by work is spontaneously decreasing as well. Therefore it is necessary to replace this source with "non work" free time activities. In addition, mostly according to recent changes in our society – competitive tensions lead both to an increase in the quantity of time devoted to money earning activities, and to an increase in the psychological load as well. Its reduction to an acceptable level increases the demands for complete physical potential. The cliché "the amount of free time is growing" is, from this point of view, quite uncertain, in according to the general increase in demands for complete physical disponibility. But this is not the decisive factor. The solution of the problem of maintenance of and increase in physical activity is very relevant and is concerned with both quantitative and qualitative parameters. A positive element in this context is the relatively high growth of possibilities. Within these possibilities the importance of motor and sport activities in a natural environment is playing a major role.

The task of the natural environment in relationship to motor and sport activities is a matter of importance from various aspects (Green & Chalip, 1998; Sallis, Bauman, & Pratt, 1998; Spence & Lee, 2003; ...). It is not only because of the possibilities which are offered by outdoor sports for the development of travelling

and for the wide range of possibilities of physical activities nor is it due to environmental risks. At present outdoor sports are considered among children, youth and adults to be activities which give us a big charge and fill us with impressions. This is how activities in a natural environment multiply their positive influence on health.

The scale of motor and sport activities in a natural environment is wide and constantly growing – both in offers "for everybody" as well as in the extreme aspects differentiating the possibilities of realisation. This scale is defined by its character according to many aspects – effectiveness according to its influence on complete physical disponibility, time and space demands, demands for material, technique and financial management, conditions existing in connection to infrastructure affecting realisation possibilities, effects on maintenance, an increase in physical and psychological potential and both general and "special orientation".

We can divide the motor and sport free time activities into groups from many different aspects (outdoor – indoor, winter – summer, by prevailing demands for basic disponibility, motor potential, a focus on the development of motor abilities or skills, quantity and quality of time, space, material and technique parameters, individual – collective, etc.). One of the dominant points of view gives us the possibility to divide motor or sport activities into those which are practised in a natural environment, "outdoor", and those which are practised in gymnasiums, fitness centres, sport halls, indoor swimming pools, simply "indoor". Regarding all basic criteria of their effect (making for

good health, physical and functional potential, development of psychological potential, increasing resistance stability towards the negative effects of work load, etc.) then the motor, sport and hiking activities practised in a natural environment dominate due to the complexity of their effect (Blahutová, Rak, & Ramacsay, 2000a, b; Hellebrant, Ramacsay, & Turinič, 2000; Mederová & Šelingerová, 1994; Medeková, 1997; Petrovič & Turinič, 1999; Scholzová & Ramacsay, 1999; Thurzová, Kutlík, & Orviský, 1999; Turinič, 1999; Turinič & Kutlík, 1999; Šimonek, 2000; Štulrajter & Záhorec, 1999; Švajda, Záhorec, & Žiškay, 1999; Zařko, Švajda, & Záhorec, 1998; Záhorec, 1999; Záhorec & Zařko, 2000; Židek, Orviský, & Ramacsay, 1999; Židek, Orviský, & Záhorec, 2000; Žiškay, Šimonek, Švajda, & Záhorec, 1999; Žiškay, Švajda, & Záhorec, 1997; Žiškay, Švajda, & Záhorec, 1998; ...). The amount of quantitative and qualitative parameters in these kinds of activities is very large, especially according to the claims for motor disponibility, space, time, material and technique demands. That is why, for example, downhill and cross-country skiing in winter season, and all kinds of hiking (trekking, water activities, mountain biking, etc.), cycling, swimming, etc. belong to the group of activities dominating due to the number of youth and adults who prefer them (Ramacsay et al., 1996; Pavlíková, 1996; Havlíček et al., 1996).

Spending free time in motor, sport or hiking activities practised in a natural environment with such quantitative and qualitative parameters as allow us to reach the appropriate effect, means fulfilling specific conditions. Mainly it consists of the existence of a valid infrastructure, services, material and technique management, financial accessibility, availability, etc., which also influence the structure and orientation of interests. Skiing, downhill and cross-country are both determined by natural and meteorological circumstances – mountains, snow. They are different according to many other factors which influence their spreading. The material, technique and financial demands of downhill skiing, demands for a suitable terrain, their adjustment, relevant infrastructure and services, all these elements are much higher than in the case of cross-country skiing. According to their influence on maintenance and growth of functional disponibility, physical condition, health, etc. these demands naturally belong to highly effective motor activities and sports in nature (Hellebrant, Ramacsay, & Turinič, 2000; Petrovič & Turinič, 1999; Židek, Orviský, & Ramacsay, 2000; Židek, Orviský, & Záhorec, 2000; Blahutová, Rak, & Ramacsay, 2000a, b). Nowadays the question of appropriate equipment is a question of financial accessibility (which is in the case of downhill skiing much higher). The biggest problems related to spreading skiing (mainly downhill skiing) as a free time activity, maintaining or increasing of physical conditions, fixing health problems, establishing psychological stability with regard to the negative consequences of work load, etc. are not simple to solve. It is

necessary to consider these problems not only in the already mentioned way, but first of all according to the existence of ski centres and their appropriate facilities (mainly their infrastructure), financial accessibility of appropriate services (transport, accommodation, restaurants, service, etc.) and also in the ability to eliminate the influence of meteorological factors during the ski season.

## WORK OBJECTIVE

The objective of our study is to analyse the determination of motor, sport and hiking free time activities in a natural environment according to motivation factors both generally and in the field related to downhill skiing.

## METHODOLOGY

The basic research sample was made up of 955 respondents, who answered a questionnaire mainly in the environment closely connected to the realisation of their favourite motor, hiking, or sport activities (hiking meetings, collective hiking activities, ski courses, ski centres, etc.). The questions presented in the questionnaire were answered by 265 of a total number of 955 respondents during ski courses and in ski centres. Although not all of the respondents preferred downhill skiing to motor, hiking or sport activities in their free time, this way of spending their free time was one of the most preferred. The third group consisted of 87 respondents separated for the process of evaluation of the results according to the defined goal of our work. In the case of free time activities, these respondents marked downhill skiing in first place.

We attained initial information by anonymous questionnaire, consisting of 27 questions divided into two basic parts:

- questions focused on gathering data about free time, physical education, motor, sport and hiking activities,
- questions about personal data.

To elaborate and evaluate the initially gained data we used percentage frequency analysis and the test of mutual association or relations between qualitative characteristics. This test was based on verifying and evaluating the difference between expectations and experimental multiplicity in contingent tables with the help of a  $\chi^2$  test (Bakytová, 1979; Reisenauer, 1965).

## RESULTS

### The structure of interests and realisation of many different motor, hiking and sport activities in a natural environment in people's free time

The research sample contained 52.8 % men and 47.2 % women, or 61.1 % men and 38.9 % women with an orientation to skiing. In their own opinion, 46 % of the respondents ranked themselves among

healthy people in good condition, 27.3 % among those healthy but in poor condition, 22.3 % – no serious health problems, 1.3 % – serious health problems and 0.6 % were physically handicapped (0.5 % didn't respond and 2 % ranked themselves in the category "other" without specification). Basically, it was a sample of healthy people with varying physical condition. Of the respondents, 78.4 % were single, 19.7 % were married, 0.9 % were divorced and 0.2 % were widowed (0.7 % didn't respond). In both cases, about one half of the respondents (55.2 %, 51.3 %) were people under 18 years of age. The respondents fell into age categories as follows: 20.4 % or 33.2 % of the respondents were aged between 19 – 25 years, 3.4 % or 4.2 % between 26 – 35 years, 17.7 % or 4.5 % between 36 – 45 years, 4.7 % or 3.8 % between 46 – 55 and 4.3 % or 2.3 % between 56 – 65 years and, in the category over 65 years, 0.2 % or 0.4 %. The dominance of young and middle aged people is obvious. Persons with primary and secondary education dominated in the whole sample and also in the ski oriented sample. The difference was only in reverse order – 44.1 % and 38.6 %, or 35.5 % and 48.7 %. Respondents having a complete university education were represented equally in both of the samples – 17 % or 15.1 %. In the whole reference sample psychologically difficult jobs prevailed (50.2 %) over jobs which required both physical and psychological effort (34.6 %). In the ski orientated sample these two kinds of jobs dominated as well, but in the reverse order. The majority of the respondents had a job requiring both physical and psychological effort – 56.2 %. Jobs based on psychological effort constituted 28.7 % of this sample. Psychologically based jobs made up only 4.9 % or 5.3 %. Surprising was the number of respondents who didn't answer this question, 10.4 % or 9.8 %. An even higher number of respondents refused to answer the question concerning the basic evaluation of their own incomes – 17.8 % or 27.9 %. Nearly the same relative number in both groups – 20.1 % or 20.4 % consider their income to be sufficient. However the majority of the incomes were marked as "rather sufficient" or "rather insufficient" – 27.1 % or 26.9 % in the whole sample and 26 % or 21.3 % in the ski oriented sample. Their income was considered to be totally insufficient by 8.1 % or 4.2 % of the respondents.

We can characterise the reference sample as balanced. It represented both men and women, mostly young and middle aged people. The majority of these individuals were healthy with differentiated physical condition, from all education levels, especially primary and secondary education. They are presented in a wide range of jobs, mostly based on psychological and combined (psychological and physical) effort. According to respondents' evaluation, their incomes are very different.

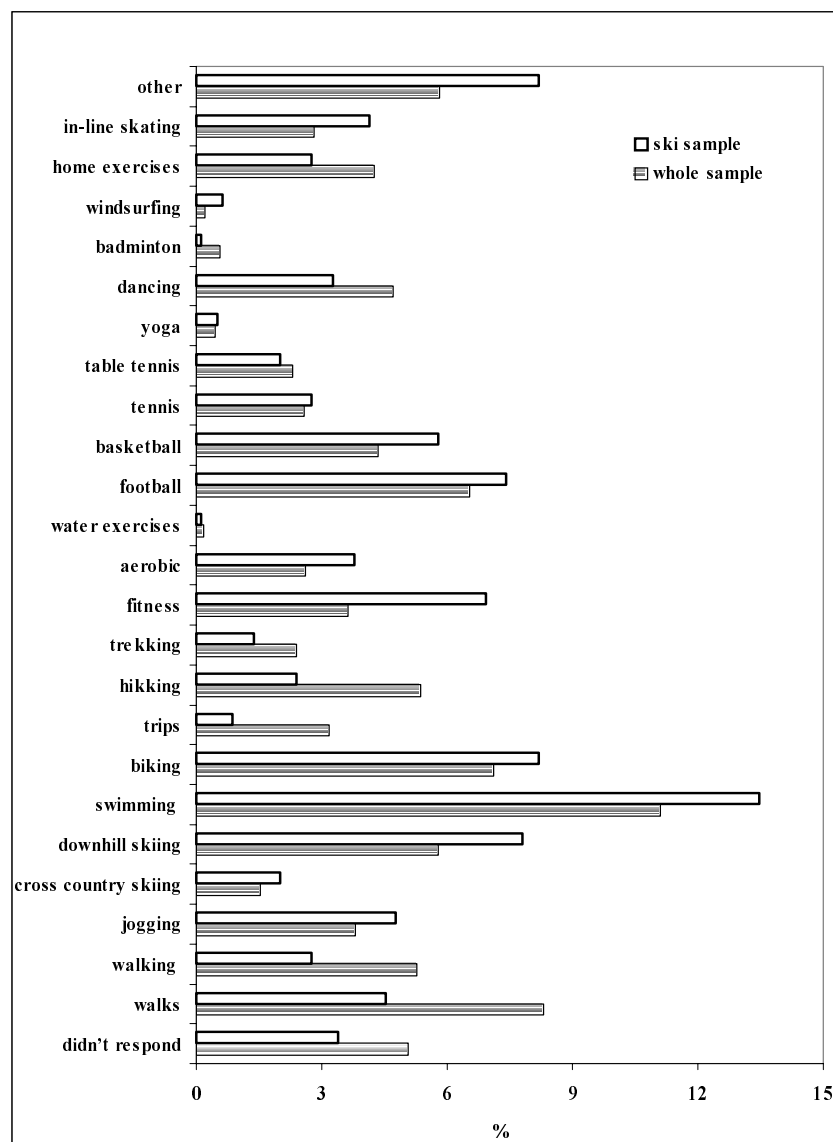
Even if relatively many respondents (compared to other percentage values) didn't answer the question about their favourite free time activities (6.8% or 8.6%), the dominance of four ways of how to spend

free time is evident. It involves both the whole and ski oriented sample. In the whole sample this group of preferred activities is made up of watching TV (15.7 %), hiking and sport activities (15.6 %), listening to music (15.4 %) and meeting friends (11.7 %). The same "activities" were preferred also in the ski oriented sample, only the order was different (hiking and sport activities 19.2 %, watching TV 16.0 %, listening to music 15.2 %, meeting friends 13.7 %). Even if hiking and sport activities take an important position among the four free time activities, the proportion of passive ways of spending free time remains very high (further positions are taken by other passive ways of spending free time). As a positive element we can only consider the dominance of hiking and sport activities in the ski oriented sample. Concerning male respondents, these activities dominate in the whole sample (10.8 %), over watching TV (9.4 %) and listening to music (8.3 %). Concerning females they are located only at the fifth position (5.9 %) after listening to music (8.3 %) watching TV (7.5 %) meeting friends (6.6 %) and reading (6.3 %). These results are surprising also according to the age of the respondents – mostly young and middle aged people.

We present the results of percentage frequency analysis of respondents' orientation according to the dominance of preferring specific hiking and sport activities or according to interest in them. (Fig. 1 and 2). Quite shocking is the relatively high percentage of those who refused to respond to this question according to their preference of interest in specific sport or hiking free time activities (13.2 % or 9.9 % – the highest values compared to the proportion of individual activities and the willingness to practise them, as well). According to the preferred free time activities, swimming (11.1 %), hiking (8.3 %) biking (7.1 %) and (European) football (6.5 %) dominate in the whole sample and swimming (13.5 %) biking and "other activities" (8.2 %) and downhill skiing (7.8 %) dominate in the ski oriented sample. The situation according to interest in particular sports and hiking activities is much more balanced. From 24 offered possibilities swimming, tennis, downhill skiing, biking, trekking, in-line skating, fitness (8.7 % – 7.0 % – 6.9 % – 5.6 % – 5.6 % – 5.3 % – 5.1 %) dominate in the whole sample and downhill skiing, tennis, swimming, in-line skating, "other activities", biking and windsurfing (8.8 % – 8.4 % – 7.7 % – 7.0 % – 6.5 % – 5.9 % – 5.9 %) dominate in the ski oriented sample. In the whole sample, less preferred activities according to practising them are exercises in water, windsurfing, yoga and badminton (0.2 % – 0.2 % – 0.5 % – 0.6 %). In the ski oriented sample they are walking, home exercises, badminton, hiking and yoga (0.3 % – 0.5 % – 0.8 % – 0.8 % – 0.9 %). In the whole sample the activities according to interest or disinterest are walking, home exercises, exercises in water and badminton (0.7 % – 0.9 % – 0.9 % – 1.2 %). In the ski oriented sample they are badminton, exercises in water and yoga (0.1 % – 0.1 % – 0.5 %).

**Fig. 1**

Preferred activities (ski sample, whole sample)



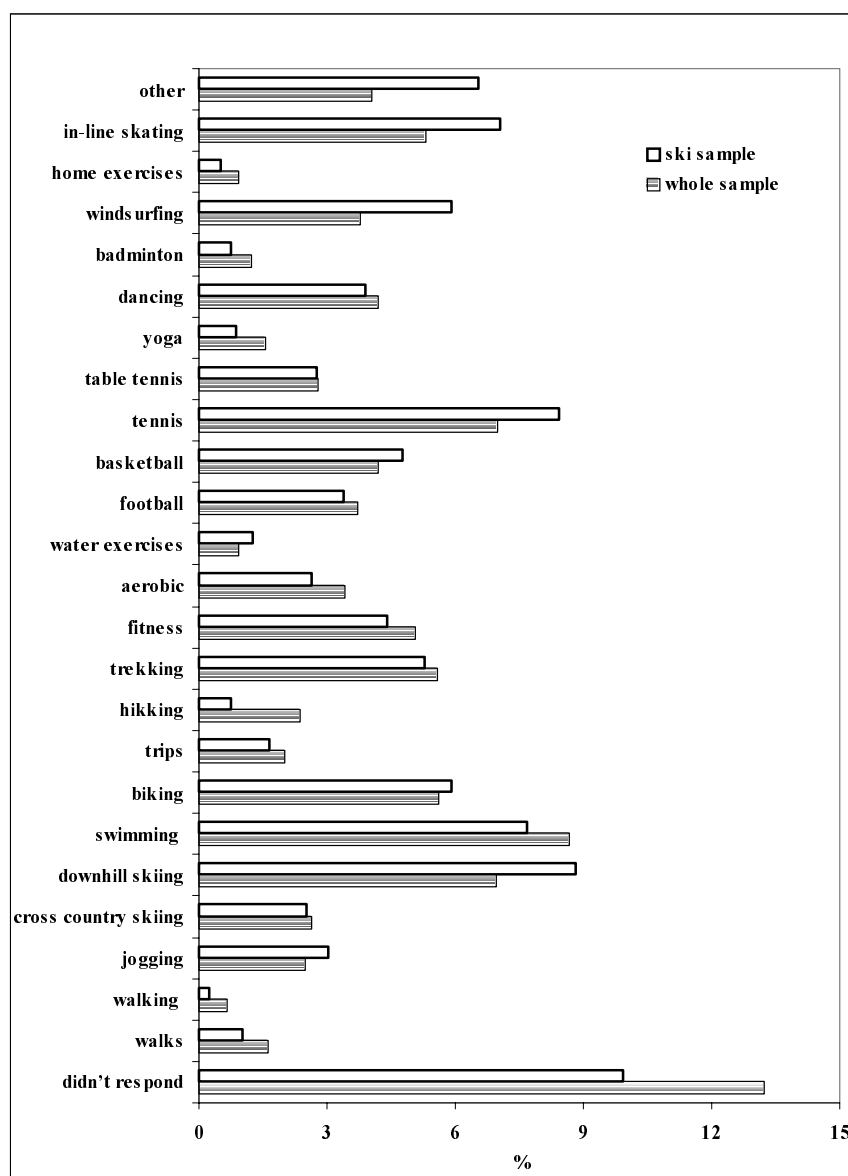
According to the objective of this study, an important factor is the answer to the question why the respondents who do motor, sport or hiking activities in their free time, prefer one specific activity. We present the percentage frequency analysis of motivation factors in Fig. 3. If we don't take into account the relatively high number of those who refused to answer this question (16.6 % in the whole sample and 15.1 % in the ski oriented sample) the dominating motivation factors for the whole sample are entertainment, development of physical condition, health improvement and body forming (12.9 % – 11.6 % – 11.1 % – 10.1 %). In the ski oriented sample, the motivation factors are the same except for exchanging the position of health improvement and body forming (14.8 % – 14.1 % – 9.7 % – 9.4 %). On the other hand, a negligible motivation influence occurred in modern life style or doctor's recommendation, because my friends do sport, "different factors" and social contacts. The percentage

values of all factors listed above are below the 1% level.

#### **Determination of motor, sport and hiking free time activities in a natural environment according to motivation factors**

The results of the relation analysis between the most preferred free time activities and reasons for preference of motor, sport or hiking activities (Fig. 4) in the whole sample demonstrate the high importance of their relations (1 % statistical importance level – below sil). At the same time it is an example of those cases where the dominant multiplicity of the combination activity <> motivation factor is coherent with dominant partial part of the total value  $\chi^2$  test as a degree of mutual dependence. We proved that even those respondents who prefer watching TV as a free time activity are clearly aware of the function of hiking, sport and motor activities, first of all to improve

**Fig. 2**  
Interest in activities (ski sample, whole sample)



health and physical condition. These two groups together with the group of respondents who prefer hiking and sport activities primarily because of having the pleasure of movement are the determining groups. These groups play the major part in the total value of explication of different actions' variability and free time activities by the variability of motivation factors (Fig. 4).

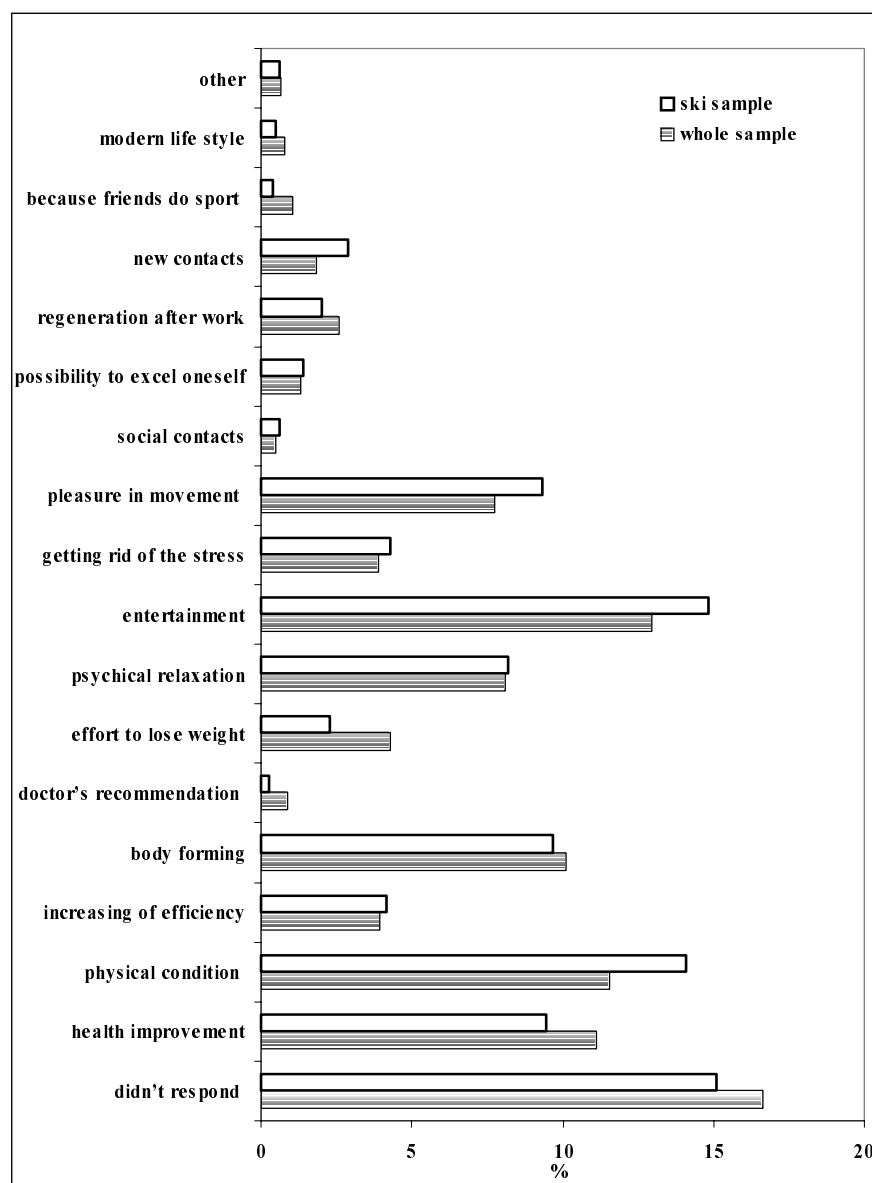
If we look at the mentioned circumstances according to the sample of respondents who indicated downhill skiing as the most preferred sport and hiking activity, we find nearly the same situation of percentage dominance. But the situation is very different in the relation between motivation factors and dominating or free time activities (Fig. 5). The total value of the  $\chi^2$  test 195.6 (5 % sil) is mostly influenced by – in this case – small groups (computer game fans who think they could be attracted to sport, motor and hiking activities by their friends who do these sports).

However, the difference between the expected and real multiplicity in this group of respondents oriented mostly to downhill skiing is the biggest one.

The relation between the percentual proportion or the variability of specific kinds of motor, sport or hiking activities and the proportion or variability of motivation factors is significant again (1 % sil) only in the case of the whole sample (Fig. 6). No important relation was found in the sample of downhill skiing oriented respondents.

In the case of the relation between the percentage proportion or its variability, interest in particular kinds of motor, sport or hiking activities and proportion, or variability of motivation factors, the situation is identical to the previous one only in view of the fact that important values were found just in the whole sample (Fig. 7). The situation is completely different according to the partial proportion in the total explication of variability of the interest in particular motor, sport or

**Fig. 3**  
Motivation (ski sample, whole sample)



hiking activities by variability of motivation factors. There are two major groups making a crucial contribution to the total explication of mutual relation  $\chi^2$  – test (1 % sil). The first group prefers home exercises to relax after work (28.7 %) and the second one prefers water exercises with a motivation where the body forming result is uncertain (22.6 %)(Fig. 7).

Questions concerning basic personal data formed a specific group. In this group we analysed the questions related to motivation factors about sex, age and education. Results of this analysis are presented in Fig. 8 and 9.

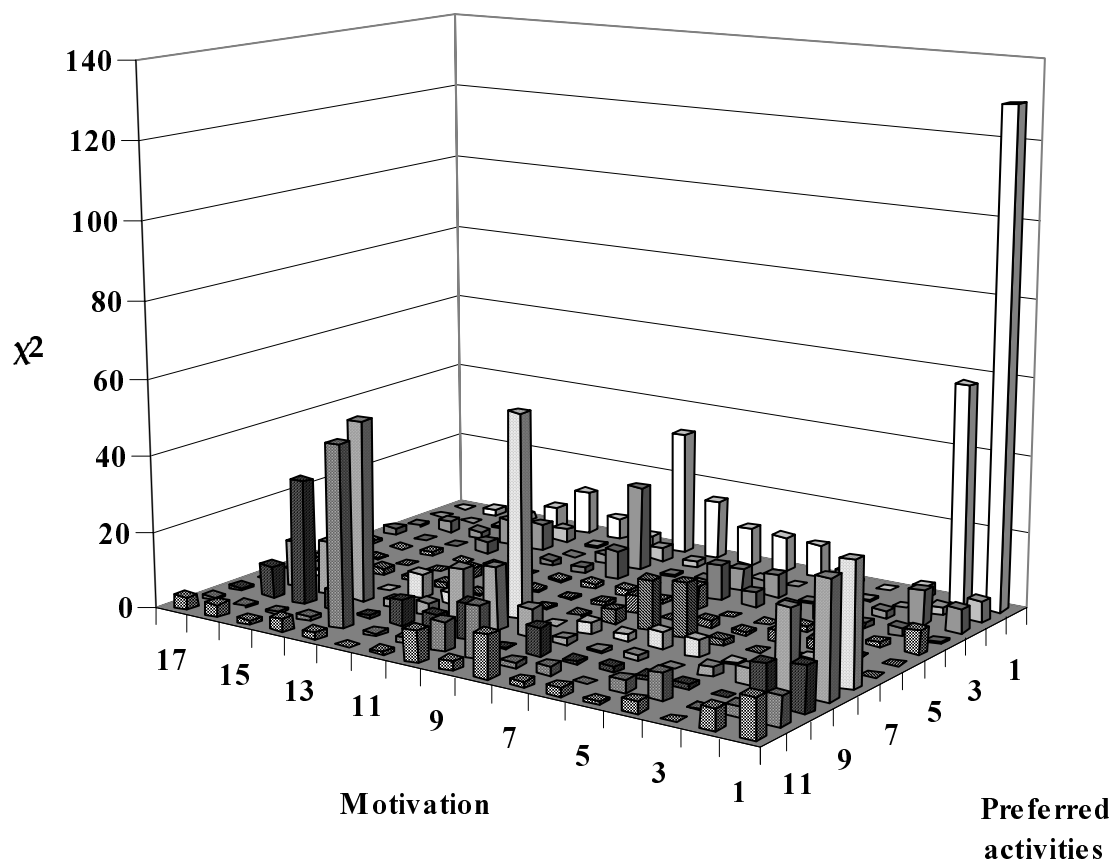
The mutual relation between sex and motivation factors is very strong (1 % sil) (Fig. 8). Both in the male and female samples, sport and hiking activities are preferred because of the motivation of potential body forming and the effort to lose weight. In the

downhill skiing oriented sample, the different sex and different motivation factors are mutually influenced only at a relatively low level (12.4 % sil).

According to the age of the respondents (age groups) in connection to dominating motivation factors – in a very close relation between these two areas – total value  $\chi^2$  – test 402.3 (1 % sil) – are highly represented mostly by groups of respondents practising sport and hiking activities dominantly motivated by the factor of regeneration after work – at the age of from 36 to 45 years, from 56 to 65 years and in the group of respondents younger than 18 years old, the youngest ones also because of psychological relaxation (Fig. 9). In the sample of respondents preferring downhill skiing as a motor activity in their free time, we did not find any important connection between these fields.



**Fig. 4**  
Motivation – preferred activities (whole sample)



## SUMMARY

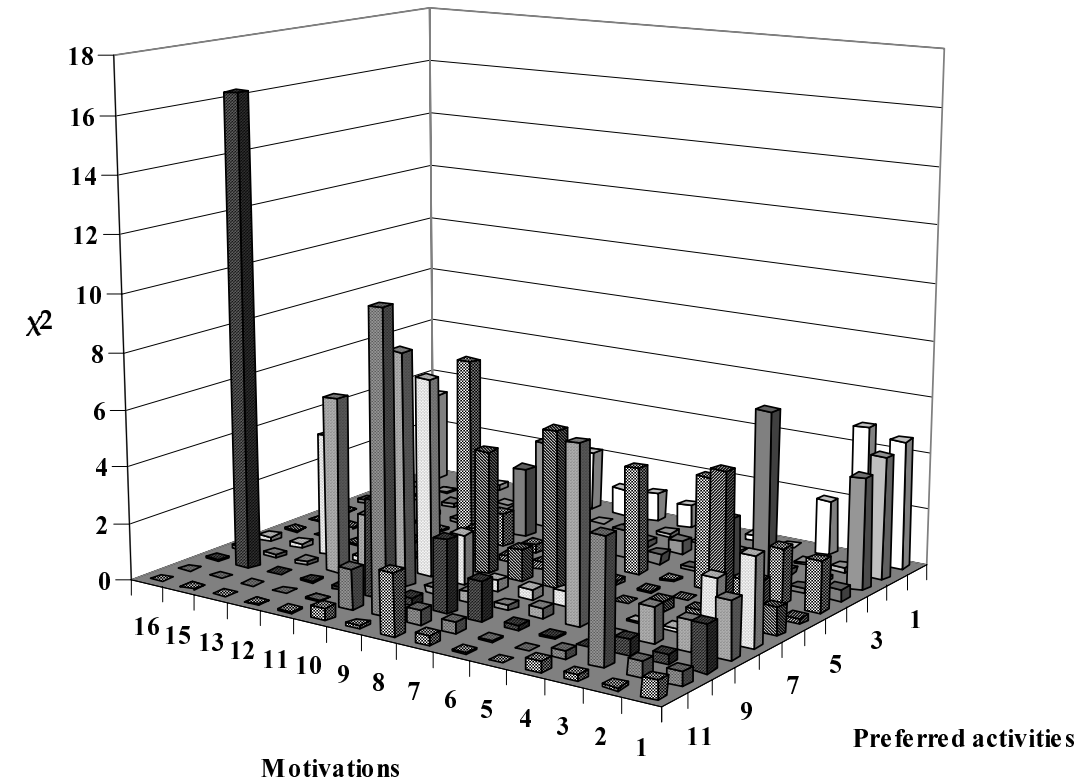
The final results according to the objective of our study predominantly come from the multiplicity and structure of the reference samples. Briefly it can be characterised as balanced as for representation of men and women; the samples are mostly formed by young and middle aged people, mostly healthy individuals with varying physical condition, of all education levels but the majority had primary and secondary education. There is a great scale of jobs, mostly with psychological and combined (psychological and physical) effort necessary to practise them and very different incomes according to their own review.

According to the determination of motor, sport and hiking free time activities in a natural environ-

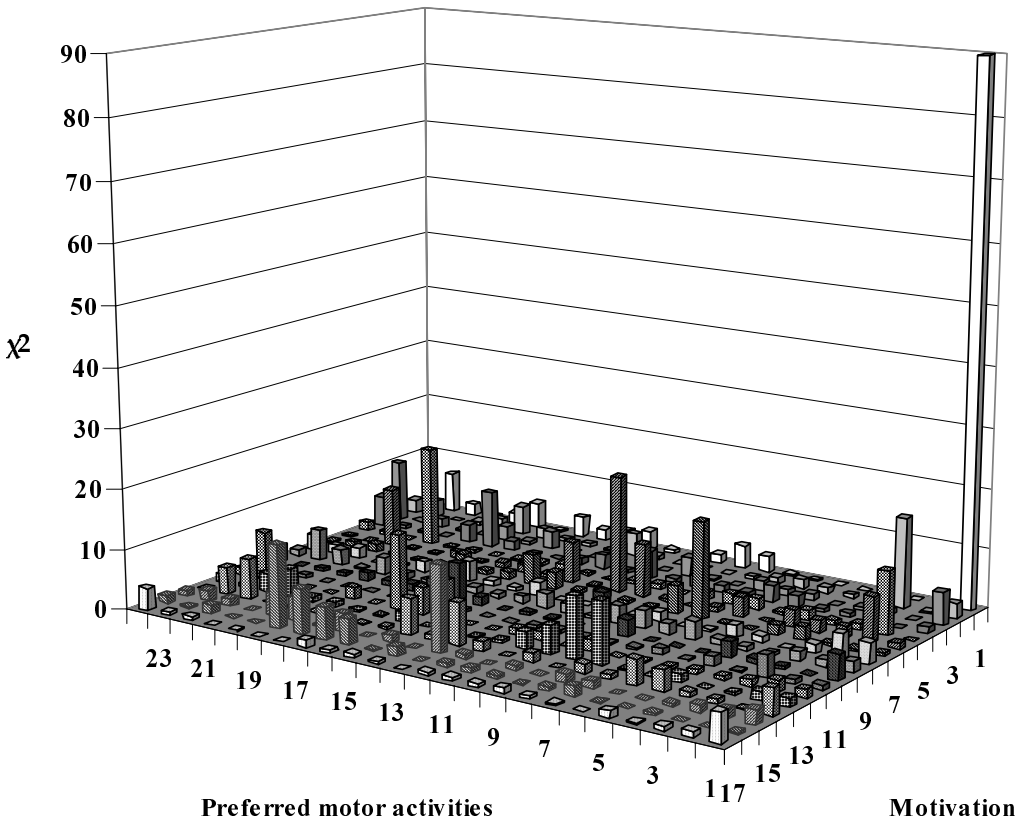
ment with different motivation factors in both samples, the following results were found:

- In the whole sample the motivation factors were significantly related (statistically, in the levels of 1 % and 5 %) – to free time activities (also “activities”), to preference of sport and hiking activities. It was according to both practising and interest; according to personal data – sex and age.
- In the sample of respondents oriented mainly to downhill skiing, motivation factors were significantly related (statistically, at the levels of 1 % and 5 %) – to free time activities (also “activities”). Connections between motivation factors, preferred sport and hiking activities and sex and age were statistically unimportant, according to practising and to interest.

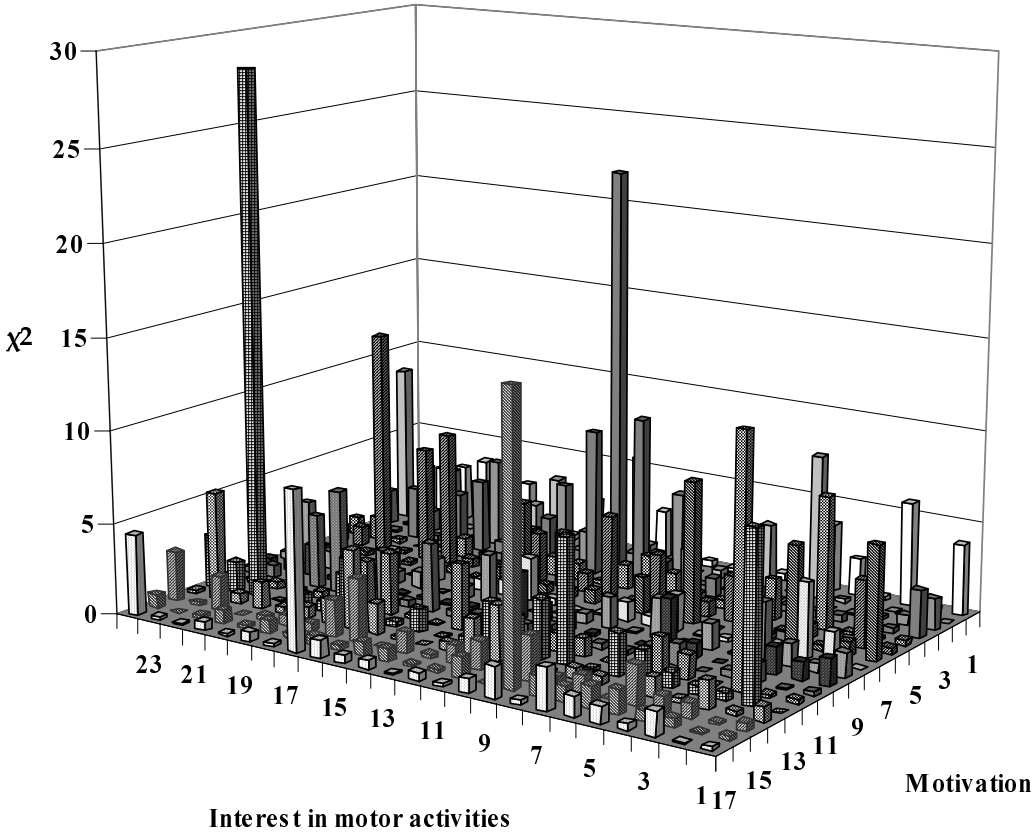
**Fig. 5**  
Motivation – preferred activities (ski sample)



**Fig. 6**  
Motivation – preferred motor activities (whole sample)



**Fig. 7**  
Motivation – interest in motor activities (whole sample)



**Fig. 8**  
Motivation – sex (whole sample)

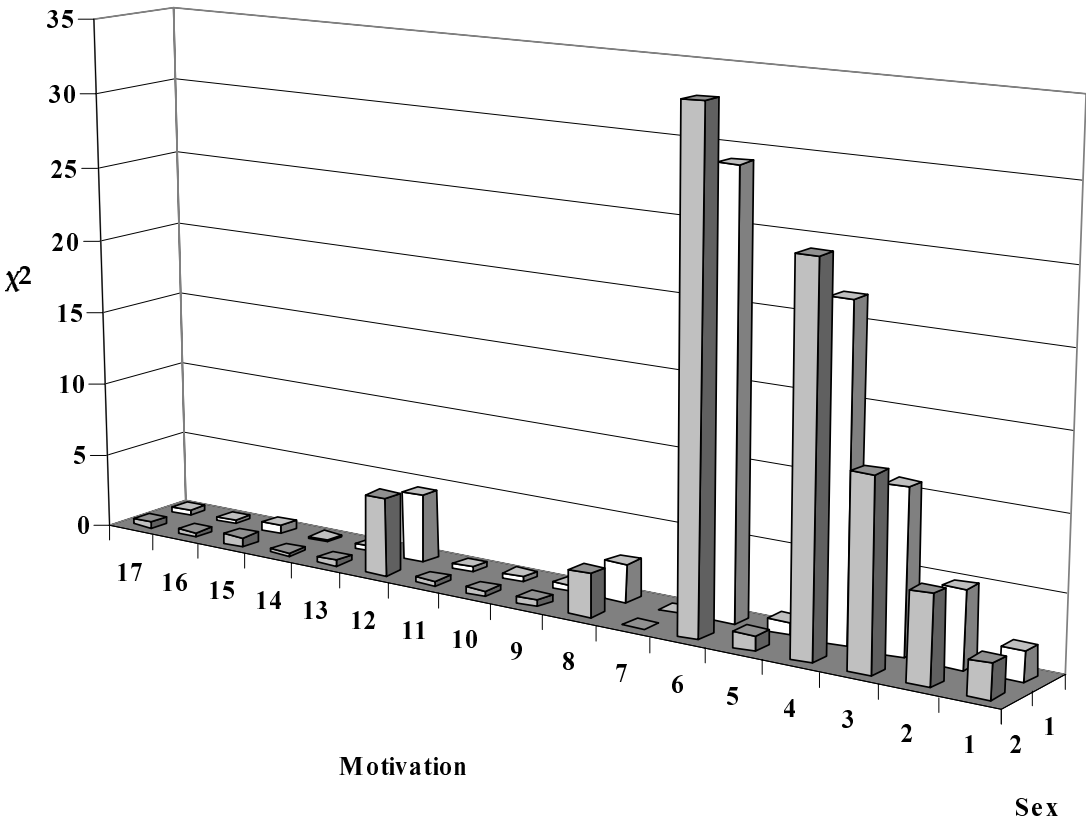
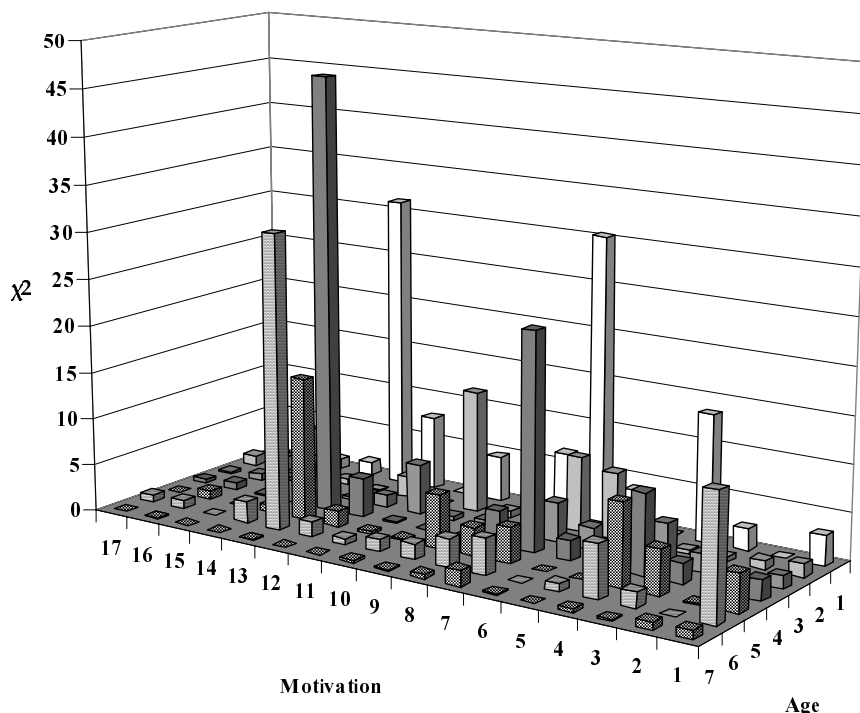


Fig. 9

Motivation – age (whole sample)



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# **SPORTOVNÍ, POHYBOVÉ A TURISTICKÉ AKTIVITY VE VOLNÉM ČASE Z HLEDISKA MOTIVAČNÍCH FAKTORŮ (SJEZDOVÉ LYŽOVÁNÍ) (Souhrn anglického textu)**

Sumarizace získaných výsledků z hlediska cíle práce vychází především z četnosti a struktury referenčních souborů. Stručně je možno ji charakterizovat jako vyváženou z hlediska zastoupení mužů a žen; jsou tvořeny převážně osobami mladé a střední generace, mezi nimiž je většina zdravých jedinců s diferencovanou kondicí, všech vzdělanostních úrovní s většinovým podílem základního a středoškolského vzdělání. Disponují pestroutou paletou zaměstnání s převahou duševní a kombinované (duševní a fyzické) námahy potřebné k jejich vykonávání a značně diferencovanými příjmy z hlediska posouzení samotnými respondenty. Z hlediska determinace pohybových, sportovních a turistických aktivit ve volném čase v přírodním prostředí diferencovanými motivačními faktory, a to jak všeobecně, tak i v oblasti týkající se orientace na sjezdové lyžování, výsledky práce přinesly následující poznatky:

- v celém souboru motivační faktory významně (statisticky, na hladinách 1 % a 5 %) souvisely – s aktivitami (i „aktivitami“) ve volném čase, s upřednostňovanými sportovními a turistickými aktivitami, a to jak z hlediska realizace, tak i zájmu; z hlediska osobních údajů s pohlavím i věkem,
- v souboru respondentů orientovaných prioritně na sjezdové lyžování motivační faktory významně (statisticky, na hladinách 1 % a 5 %) souvisely – s aktivitami (i „aktivitami“) ve volném čase; vztahy mezi motivačními činiteli, upřednostňovanými sportovními a turistickými aktivitami, a to jak z hlediska realizace, tak i zájmu, pohlavím a věkem, byly statisticky nevýznamné.

*Klíčová slova: pohybové a sportovní aktivity v přírodním prostředí, motivace, volný čas, sjezdové a běžecké lyžování.*

**Appendix – selected questions****Activities**

1. watching TV
2. listening to the radio
3. listening to music
4. reading (books, magazines)
5. cinema, theatre, cultural events
6. sport events (as a spectator)
7. housework
8. hiking and sport activities
9. meeting friends
10. computer games
11. gardening
12. other

**Motivation**

1. health improvement
2. physical condition
3. increasing of efficiency
4. body forming
5. doctors recommendation
6. effort to lose weight
7. psychological relaxation
8. entertainment
9. getting rid of the stress
10. pleasure in movement
11. social contacts
12. possibility to excel oneself
13. regeneration after work
14. new contacts
15. because friends do sports
16. modern life style
17. other

**Motor, sport and hiking activities**

1. walks
2. walking
3. jogging
4. cross-country skiing
5. downhill skiing
6. swimming
7. biking
8. trips
9. hiking
10. trekking
11. fitness
12. aerobics
13. water exercises
14. (European) football
15. basketball
16. tennis
17. table tennis
18. yoga
19. dancing
20. badminton
21. windsurfing
22. home exercises
23. in-line skating
24. other

**Age categories**

1. to 18 years
2. 19 – 25 years
3. 26 – 35 years
4. 36 – 45 years
5. 46 – 55 years
6. 56 – 65 years
7. over 66 years

## PHENOMENON OF HUMAN SELF-OVERLAPPING – STARTING POINTS AND RELATIONS (CONNECTION WITH THE SPHERE OF PHYSICAL CULTURE)

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This essay about the phenomenon of human self-overlapping presents an evident plurality of approaches and theoretical definitions of this phenomenon. On the basis of historical, philosophical, psychological and sociological starting points the author tries to systemise knowledge and creates his own, temporary dual structure of the self-overlapping phenomenon. The given phenomenon is suitable for understanding within the intention of the strategy of managing stressful situations (coping styles) as one of the possibilities for a constructive approach towards these situations. For the precise content of the definition of the term “self-transcendence” the author recommends choosing a horizon or a background of phenomena, in this case the meaning of life (will to find meaning). The end of this essay is created by the characteristic of a field of possible occurrences and future diagnostics of phenomena, that is the field of physical culture (sport).

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*Keywords: phenomenon, self-overlapping, self-transcendence, transcendence, physical culture.*

The orientation and structure of this article is already given by its title. For the philosophical research by someone who does not want to be limited to the standard scientific procedure of external observation, measurement and experiment, it is necessary to use a different method. This different method is the method of investigation of experience that its author Edmund Husserl called phenomenology. Husserl's forerunner within this trend was Immanuel Kant. If I scan whatever subject it doesn't appear as it would be, the only thing, but it appears necessarily in space. Each observation goes on also in limited time. According to Kant, two pre-experienced forms (a priori) – space and time are the conditions of each sensual observation. Husserl's generalisation meant not to observe a result (it means the recognition of a thing) but the foundation and procedure of experience itself even sooner than it comes to this recognition. Not the aim and content are searched through, but what this content mediates. For this detaching from the aim and content he uses the term phenomenological reduction. This nevertheless reducible primal information of one's own perception that can be described and determined is called a phenomenon (Sokol, 2002).

The above mentioned term “phenomenon” may also be appended by the explanation that is presented in *Filosofický slovník* (1998): phenomenon (from Greek *Phainomenon*) – something that appears and shows, in the broad sense, everything that occurs.

Because the phenomenological method is the philosophical method, it is thus not put together with some limitation of classical sciences. It doesn't have to

be limited to some isolated measurement and accessible facts but it can also investigate phenomena that appear to us, for example beauty, sense of conduct, self-overlapping, faith etc.

When studying literature that deals with the term human self-overlapping, I gained the feeling that there is not likely to be a homogenous perspective for understanding the meaning of the term self-overlap. I would like to propound the set of approaches and knowledge and we can of course discuss the assumption. This set tries to arrange and particularly systemise theses about one of the phenomena of human existence.

From the beginning it is necessary to call attention to the fact that numerous authors substitute the term self-overlapping with self-traversing, transcendence, self-transcendence, and transgression. We now regard these terms to be equivalent and will refer to possible necessary content differentiation in time. Ottův slovník naučný (1906) describes transcendence as a sphere of terms which overlaps experience and lies beyond the bound of experience. From Latin *Transcendere* = transgress, exceed.

German uses, for self-overlapping, these terms: *Selbstüberschreitung* (self-overlapping, self-traversing) *Transcendenz* – *überschreiten der Erfahrungsgrenzen*, *das Übersinnlich* (transcendental, overlapping senses); *die Jenseitigkeit* (overlap to the other side of the unrecognised).

Frankl (1997), whose approach to phenomenon will create one of the main lines of this work, characterises self-overlapping as *Selbst-transzendenz* – der

Grundlegende Tatbestand, dass Menschsein über sich selbst hinaus auf etwas verweist, das nicht wieder es selbst ist. Translator K. Balcar translates this as orientation or direction to something other than himself. One can manage if some other subject or target (than oneself) has got a bigger value at the moment. One is concerned more with “a thing” than with oneself and overlaps one’s self-centralism.

English uses for self-overlapping: to overcome one’s limitations, to find a previously undiscovered capability in oneself.

For the purpose of reviewing a plurality of approaches we present several content-oriented definitions of the phenomenon. The already mentioned Frankl understands the phenomenon of human self-overlapping as one of the basic anthropological realities of human existence.

Kohák (1993) reminds us of an already existing discrepancy that has appeared in history and stigmatises the whole European tradition. Duality – on the one side there is “self-realisation” and on the other side self-consignment or self-transverse of this self-realisation through service. The straight ideal is found by him in Christianity which doesn’t search for the sense of life in self-satisfaction but in self-transversing (Kohák uses for self-overlapping the term self-transversing). This self-transversing is understood by him to be the wish to practise good, not from the longing to prey for oneself, but growing out of respect for others, for everything good, towards one’s own human relatives as well as the external world and to take responsibility for good.

According to Janát (1999), the world we live in has got two different dimensions and two contrary powers exist in it. Our life is a life within an alternative; in the position to make a radical decision. On one side there is everything that is clear at first sight, distinct and reachable, and on the other side there is everything that is by nature transcendent, hardly reachable, unreachable as it were, passing each particular determinateness, everything that sounds with the tone of distant promise, longing, expectation, challenge. Janát conceives transcendence as the fundamental spiritual, ethic, existential and historical performance of human beings, thus creatures called upon to pass and traverse the horizon of reality into which they have been thrown (situated) by nativity.

Librová (1994) in her monograph “Pestří a zelení” introduces the term transgression, she presents it within the range of the possibilities for the fundamental anthropological determinateness of humans. Transgression is a type of a human activity that is opposite to repetitive, reproductive activities, typical of nature. Human beings are the only race not satisfied with everything they are and with their activities they transgress (overlap) their actual properties and being. Transgression activities are autotelic, they have value in and of themselves. Human necessity and value is in the performance of these activities itself and not their aim. Reaching the goal doesn’t lead to sedation but

stimulates one to further activity. One can transgress (overlap) one’s own being to different objects: one can transgress to things by gathering things (consumer lifestyle), transgress to people by longing for power, controlling other people or vice versa attendance to one’s fellows, transgress to oneself – efforts for self-recognition, self-improvement, self-realisation, or transgress to symbols through scientific activity, art, religion and other spiritual activity.

Hogenová (2000) understands self-overlapping as a fundamental phenomenon of sport. It means the basic sense of practising sports at all. Each victory is a victory over oneself, surmounting oneself, it is self-overlapping.

According to Šípek (consultation), we understand by self-overlapping the inspection of one’s own personality within a context unrecognised so far. Reaching recognition and assumption of the sense of phenomena is the result. As a value I insert it into human life and then the possibility of self-overlapping toward this value exists.

In the literature we have traced strong ways of a philosophical approach toward transcendence. It was and is a result of searching during human life everywhere in the world. We can say that transcendence is a certain anthropological constant. If we look deeply into history and take Plato as a representative of Greek philosophy, he thus understood the way toward transcendence as a way of spiritual practise. Questions about real good and real living certainty were a basis for seeking out experience of the religious world (immortality of the human soul, the difference between this and the other world). Poláková (1995) refers to the meaning of searching for transcendence in Plato in Greek mysteries that took the form of a secret ceremony of dedication that broke the bounds of everyday experience. Inner ecstatic process was induced where the contact with honoured divinity that probably may change earthly fate was opened. The reason for this process was justified by Plato as a longing for idealism, as a longing of the immortal soul for its original divine home. According to Plato, this longing can be fulfilled thanks to caring about spirit. Searching for answers to fundamental human question about good, love, about beauty, morality and the confrontation of different opinions induces in the human mind a process of “remembering” resulting in the right solution. Poláková states that Plato was found to be the first philosopher who tried to define the archetype level itself of human drift upwards. His concept of transcendence as real being and real being as transcendence inspired many other philosophical concepts.

Kant brought us another strong philosophical approach toward transcendence. It is necessary to point out that before Kant the difference between the terms transcendent and transcendental hadn’t been found. Kant and his successors distinguished the meaning of those two terms. By using the modifier transcendental Kant named cognitive forms given before each experience. The aim of his transcendental philosophy is the



cognition of a priory sensual as well as rational forms in relation to experience subjects. Transcendence then is everything that overlaps basically and unexpressed the overall possible experience that as supersensible defies the subjective mind. Kant approached transcendence not as to a subject of investigation or adoration but more as to something to be cognised. In his conception of the primacy of practical sense he holds the opinion that theoretical meaning is a hopeless fight for never reachable logical certainty. From the practical point of view, transcendence is a direct assumption itself and is a guarantee of own freedom and good will. I cite (Poláková, 1995, 45): "To conduct oneself wisely means to conduct oneself morally in agreement with the will legislated by rules valid 'in the empire of purposes', in the world common for all free beings where the God is the head". Kant understands transcendence not as distant external instance about which we speculate but as an inner environment where we directly participate by this part of our being that does not subordinate the rules of nature but freely practises moral rules. According to Kant transcendence enables us to make decisions for good and guarantees our freedom.

The third important philosophical concept of transcendence is Jaspers's approach. This German professor of philosophy in his views as to the character of human beings in the world reminds us of the term transcendence and the possibility of its interception in religious and philosophical pictures of the world. He refers to the connection of transcendence with concrete human existence, in its freedom. I cite (Jaspers, 2000, 37): "Transcendence is for us present where the world is not felt as something that exists out of itself as something being eternal, but as transition, already the transition described in secret codes or even up to physics understood cosmologically, as special objectivity that is practically irrelevant. This transcendence from its view of the whole world being occurring as transitional is a point, to which human freedom is related". Jaspers conforms that transcendence can be made understandable even with use of the means of classical terminological thinking, but only indirectly as something that isn't understandable to this thinking. He reaches at least a formal grasp of transcendence by use of paradox, method, analogy, and questions that cannot be, for sure, unambiguously answered. Although it could seem that transcendence is some chimaera of the other world, existence experiences it as present here and now, as eternity that caresses time and penetrates by its relationship everything that exists. In touch with transcendence existence becomes clear and people, within understanding of the transcendence link become personalities able to communicate (Jaspers, 2000). It is possible to say that transcendence is thus reality only for an existence that asks and understands the answer. Jaspers uses as a medium the "speech of transcendence", so called secret codes. I cite (Jaspers, 2000, 48): "There is nothing that could be a secret code, also metaphysics is by

this self-presence of transcendence in immanence". The term, radical situation, is used by Jaspers in connection with the ability of humans to bear their fates in personally experienced situations of any wreck, that means torture, fighting, death, accidents, guilt etc. In many cases in these situations it happens that one feels the limit of our living in the world. It is connected with the invasion against or collapse of our living spiritual supports, living attitudes etc. According to Jaspers one feels the world in its originality only in those marginal situations in which one fully and truly decides how to again rebuild life supports. Here one can orient to never-ending openness, spiritual movement, into processes that have transcendent character and that create the general life of human spirit. Within Jaspers' understanding of existence there isn't self-realisation in the sense of satisfaction of needs and emancipation tendency and it is not even independence that itself is a criterion. In its fundamental freedom there is hidden grasping from elsewhere. Transcendence then is the basis for realisation of existence as a gift, as power, through which one is oneself (Poláková, 1995). We can say that Jaspers understood transcendence as an origin of existence.

A big shift in the understanding of transcendence was brought to us by the philosopher Levinas. Transcendence in his opinion is something that always radically defies the ambition of thinking to have reality in its own power. Thinking in this case touches the thinking person and exudes internally fear, love and responsibility. According to Levinas, the entrance to transcendence is not a term but a relation. In Levinas' conception there is an evident abandonment of the selfishness of the thinking "I" that determines the content of something that is for this "I" thinkable, shifted to another who instead of me becomes the determined centre of my attention. I cite (Poláková, 1995, 48): "Turning to another is to turn to thinking the unthinkable that as God and as neighbours do, we overlap inactive cognitive intention. The other is what obligates me to responsibility sooner than I may think about it". Transcendence in Levinas does not embody an idea or subject; spirituality of transcendence does not cover the assimilative act of consciousness. Relation to transcendence as being to the credit of its absolute initiative, with unthinkable consciousness does not cancel but evokes (Poláková, 1995).

Probably not all approaches to phenomenon transcendence have been considered but I think that we can finish our philosophical and historical excursion and deal with the problems of our approach and definition of the phenomenon.

For better orientation in the problem of the phenomenon of transcendence it is now important to distinguish two turning points. One of them is transcendence, or rather the transcendent situation that can be in the words of colleague philosophers determined as "certain pole, tension", a phenomenon penetrated by everything, that cannot be somehow delimited nor even structured, it is not a subject that

would have some parts. According to the facts about in what dimensions of human existence it occurs I describe and “handle” this phenomenon. The second turning point is an experience or living of transcendence. By this feeling of phenomenon transcendence is revealed. We can talk about it only in connection with human existence (self-transcendence). We can say that everything penetrating a transcendent situation is what overlaps us, what overlaps our “assuming” possibilities, sensual or intellectual. Human existence establishes relations with this transcendent situation by its self-overlapping and self-transcendence. Touching behind one’s own conscious limits. It can be said that a transcendent situation reveals itself in dimensions of self-transcendence. In order for this phenomenon of self-transcendence to be clear it is necessary to define the background against which this phenomenon is revealed. In case of human existence it could be our own way of life. The question about one’s way of life is a specifically human issue. It is not an expression of something pathological within someone but of something most humane. An animal does not ask about its way of life. Only a human can experience and try the problems of living and being. According to Lukášová (1998) the problems of the average way of life are conscious rather latently and gain the meaning thanks to frustration, stress or extreme underutilisation of one’s possibilities.

According to Frankl (1999) an animal does not know about the purposes into which it is yoked. How can anyone know what “final aim” life has, what higher aim or higher meaning the world as a whole has? According to Pascal a branch can never understand the meaning of the whole tree. Belief in some higher meaning understood as a limited term or religiously as providence has got psycho-hygienic and psychotherapeutic meaning. It is creative and refreshing.

The fact that one touches behind oneself for some purport that should be revealed and fulfilled, this aspect of self-transcendence Frankl tries to define by his motivational-theoretical concept of the will to find meaning.

Also Maslow, a representative of American humanistic psychology, emphasises and highlights that he regards the will to find meaning to be the primary effort of a human being. I agree entirely with Frankl that “one’s primary concern is to find meaning” (Frankl, 1997, 25).

Also other authorities such as C. H. Wadlington claim, that “real effort for meaning is the substantial aspect of human naturalness” (Frankl, 1997, 27).

Into the concept of “will to find meaning” Frankl includes a special kind of perception. One tries not only perceiving one’s living environment as a meaningful totality but also strives to find an explanation that shows one as a personality with an aim that should be fulfilled. In order to be fulfilled – one tries to find justification of one’s existence. Founders of the psychology of form refer to the fact that each particular situation contains the character of demands that

create the meaning with which anyone confronted with this situation should find fulfilment. The will to find meaning is defined as a specifically human feature to reveal sensual forms not only in the real but also in the possible (Frankl, 1997). This ability to find meaning in the thing that is and can be is set by Max Scheller as the ability of free recognition about the possible and it is a factor that distinguishes humans from animals. Frankl understands self-transcendence as touching humans behind ourselves. It can be called an overlapping of one’s own ego, aiming at something that we ourselves are not. It is very interesting to mention his opinion about self-realisation because its core is conversely concentration on oneself and it is in Maslow’s hierarchy of needs the top need. “Who aims at self-realisation, overlooks and forgets that a one can self-realise only to the extent of that range in which meaning is fulfilled – out in the world, not within oneself. Self-realisation somehow defies the determination of aim in that it appears to be an adjoining effect of what we call self-transcendence of human existence” (Frankl, 1997, 27).

Maslow has got the corresponding opinion that people who search for self-realisation directly, separated from a living mission, cannot really reach it. As if Maslow expressed by this claim respect to a more perfect existential conception than is his top need of self-realisation. As if he was conscious that his hierarchy of needs needn’t be valid under all circumstances. Atkinsonová (1995) presents to us the idea, in accordance with Maslow, that only when it is possible to easily satisfy fundamental needs will an entity have time and energy to devote to aesthetic and intellectual interests. The top motive – self-realisation – can be fulfilled only after satisfaction of all other needs. I think that Frankl and many his patients prove that this is not valid. Although one suffers from hunger and cold, by activation of one’s own spiritual dimension one needn’t deal within the intention of Maslow’s pyramidal scheme. Atkinsonová also criticises that psychology which highlights individual self-accomplishment and self-realisation as the top of the value hierarchy for excessive combination with an American ideology that represents psychological support of egoism.

An apparent similarity with Frankl’s theories of self-transcendence can be found in Maslow in the case of living the transitional moments of self-realisation that are so called top experiences. Top experience is the experience of happiness and fulfilment – a spontaneous, temporary state of perfection not oriented on itself and the attainment of a target. These experiences have got varying intensity and can occur in different connections (creative activity, cognition of nature, aesthetic perceptions, intimate relationships with other people, participation in sport events etc.). These experiences give evidence about values of beauty, kindness, love and truth (Atkinsonová, 1995).

According to Frankl, meaning cannot be given but must be found. When searching for meaning one is lead by one’s conscience that is an organ of modality.

It can be defined as an ability to perceive sensual forms in concrete living situations. Frankl assigns great importance to the character of conscience in connection with the origin of conformism, the totality that appears as a consequence of an existential vacuum (so called noogenous frustration). Only human conscience makes one able to oppose. Responsibility is inseparable from conscience. Each of us is responsible for our own approach to life, for our existence, for finding our version of meaning. Frankl claims that by loss of traditions that provided people with some instruction for life the meaning of life needn't vanish. Values disappear with tradition. Frankl understands values as belonging to a sensual universality that is included in situations that are typical, repeated, and signify the human condition. On the other hand, the meaning of life stays while tradition disappears. The meaning of life is always something unique, unrepeatable, something that should be primarily revealed. Frankl introduces three value categories through which it is possible to find one's way in life. They may provide a motive for one's own self-transcendence. By creative activity we refer to creative values, within living we realise and experience values (art, love, etc.). We realise attitudinal values in the attitude to determinateness. The opportunity to realise these values arises whenever one is placed against fate, how one takes it, how one bears it. These are attitudes of bravery while undergoing torture, enhancement in human performance, attitude of dignity in perdition and while dying etc. Frankl claims that as long as human beings have got consciousness, we have the responsibility to realise values until the last moment of our existence. Values of the attitude toward determinateness have got great importance also for one's vicinity. They become immortal evidence of the power of the human mind. Just in the sphere of occupying the attitude to fatefulness of the freedom of individuality's decision, importance is gained. There is not freedom from anything (illness, injury), but to something. Freedom is understood like this in Frankl's conception when freedom to make decisions and take on responsibility cannot be separated.

If we summarise once again Frankl's concept of self-transcendence to meaning that we find throughout the triad of values, it is necessary to emphasise the fact that Frankl understands human beings as entities of their physical, psychological and spiritual dimensions. Self-distancing and self-outreach abilities come out of crossing the withdrawal in the inner world of our physical-psychological dimension thanks to the power of resistance of human spirit (the spiritual dimension).

This very qualitatively elaborated system that understands the self-transcendence of humans as being rather conscious, by a motive- and will-guided process will create an important basis for practical research of the phenomenon within coping styles (strategies of coping), that means a constructive way of managing marginal stress situations.

Now other problems must be discussed. Besides Frankl's concept of self-overlapping, which has already been mentioned, as a conscious, motivated, volitional act, some secondary characteristic of self-overlapping is revealed to us. Self-overlapping gives us an immediate, unexpected insight into ourselves in, until recently unknown, connections. Achievement of cognition and the assumption of the meaning of phenomena are the results of it. Inclusion of values into human life with the possibility of conscious self-overlapping to a given value follows. This meanwhile double character of self-transcendence I have expressed simply in a scheme.

1. First idea — then conduct (a conscious, volitional, motivational act, for example Frankl's concept).

2. First conduct — then an idea (an unconscious, additionally reasoned out act).

Further study and research will show whether it is possible to find a link between the temporarily assumed double structure of self-transcendence.

As was mentioned above, transcendence undergoes a process of revelation to us in dimensions of self-transcendence. Very many of these ways of self-transcendence exist by definition.

Human desire for transcendence is possible to live and manifest also in the non-religious spheres. One of these dimensions is the sphere of sport covered by this concept together with other components in the definition of physical culture. Because this article is a theoretical preparation for the future diagnosis of this phenomenon we suppose, in the field of some sport disciplines (climbing, ski-alpinism, gymnastics etc.), the possibility of self-overlapping in the meanwhile of both types.

Practising sports brings about many various stress situations when often it is not possible to determine in advance how the situation will develop and finish. One oneself doesn't know how one will react in stress situations, whether one will try to escape, attack (aggression) or react in a constructive way (self-overlapping). Sporters, especially top sportspeople, are people of an exceptional type; they have a need to touch the limits of their possibilities. It is difficult to answer the question if certain types of sport disciplines contain this challenge or "it is in each person". Where is the motive? What is this motive that causes a sporter to risk beyond his or her limits? We can say that it is possible to find a conjunctive level between philosophy and sport. "Humans meet their transcendence when they meet their limits". Marginal situations themselves are not transcendent but it is a place, though, where I realise my own finality. On this horizon it is possible to observe self-transcendence. If I return in one sentence to Jaspers and his "marginal situations" it would be interesting to find out to what extent sport brings us into these marginal situations. We suppose that during further research about the phenomenon of self-transcendence we will follow this path.

In connection with the sphere of sport it is necessary to refer to the partial dissimilarity of the above-mentioned double structure of self-transcendence. In the centre of Frankl's self-transcendence meaning came out of one's own ego even if it is necessary to add that "one's own I" cannot be totally omitted as it is constantly in play, as in "where I bounce for self-overlap and where I fall again in another quality". In sport I am the aim of self-transcendence, it means cultivation of my ego. If we strictly implemented Frankl's concept in sport, from the point of view of creating values the disagreement would not exist, but from the point of orientation of self-overlap to one's own ego, some kind of "pseudomeaning" would originate. An eventual combination of both approaches can be taken into consideration after resolving the problem of the double structure of self-transcendence.

It is possible to talk about self-transcendence in the sphere of sport unless we have a specified relationship to the term physical culture. Approaches to the content of the term physical culture result in the concepts of the body, movement and understanding of culture, generally. History shows that opinions about these phenomena were not always homogenous and only current authors, for example Fiala, Cikler, Hodaň and others show this sphere as an inseparable part of the culture of the whole society. This subsystem of culture, according to Hodaň (2000, 63), can be characterised as a "socio-cultural system that, as a result of activities, creating values, relations and norms, ensures by specific means (exercises) the satisfaction of the peculiar biological and social needs of a person in the physical sphere and resulting psychological and social development with the aim of socialisation and cultivation of the individual. It is a part of the culture and cultural heritage of each nation. The cultural and societal human being as a full-value member of a society is the object of its action". If we continue to follow the approach of Hodaň, then an important partial field of the physical culture system is, apart from others, also the field of physical activity that includes three specific types. These are physical education, physical recreation, and sport. It is necessary to recollect that Hodaň's view of each human as a unity of physical, psychological and spiritual dimensions that contrasts in the aims and meaning of all three types of physical activity, is a basis of this term's definition. The fact that Hodaň regards each individual as a unity of physical, psychological and spiritual dimensions doesn't mean that he doesn't admit the possibility of phenomenal self-transcendence that is mostly assigned to the human spiritual dimension. The phenomenon of self-transcendence, according to Hodaň, belongs among dimensions both psychological and social.

The meaning of all three types of physical activity should be the positive and qualitative change of an individual and the enrichment of one's existence with a new quality. From this expression it is possible to gain the impression that quality of life is something that is added to life itself as its attribute, as a thing. It

is necessary to realise that the quality of life cannot be secured as a list of means by usage of which quality is produced. This rather instrumental character of term content that is presently wrongly understood, is attributable to the reduction of the human being to a functioning machine (for example the Cartesian approach). Hogenová (2002) cites Bělohradský, "to identify care about the spirit with evidence of the mathematical type leads to an objectivistic reduction of the intellect to a non-personal, formal and technical procedure...". In order to find the answer to qualitative change, it is necessary to determine anthropological theory in its approaches to body and movement that create a background against which our phenomenon can be observed. Hogenová in her monograph "Kvalita života a tělesnost" (Quality of life and corporeality) reminds us of the meanings of body conception as SOMA – body as a form, body in the meaning SARX (body as a form of individual organs under the skin) and body in the meaning PEXIS (soulful body) that have got their basis in the antique understanding of the body and life. The human body cannot be described only according to what it looks like from the outside and inside but it also somehow "is". The body is not only an object, it is not even a subject, and it is, as it were, both in one. The dualistic Cartesian approach to the body reduces things into experienced subjects and subjectivity is reduced into cogito. According to Merleau-Ponty (Hogenová, 2002, 51), "the body is not complete in the sense of all schedules given in advance where we meet things and people from the surrounding world, but these schedules just constitute the process where a so called body scheme plays its critical role". This term is explained by Hogenová as a background where figures reveal movement and these result from a contemporary connection of thinking and motorics. A body scheme is non-objective and that's why it is unknown. We say that our body scheme is so close to us that it is not possible to objectify it.

Body and movement cannot be separated; they belong together metaphorically like day and night. The movement of the body is an expression of our life. If harmony of our living movement was to happen, then, in Aristotle's words, it is necessary to harmonise all four causes: efficient, final, material and formal. Some modern scientific approaches in their theses simplify and objectify phenomena such as, for example, the human body and its movement. It would be fair to call to mind how in ancient times they understood movement. Whatever change, origin or ending, change of quantity and quality, according to Hogenová (2002, 15) "enter into phenomena on the basis of background" were understood as movements that related to the human body.

The insertion of the body into a situation is a background for what we call human movement. Scheduling of life in certain situation is a movement that heads towards fulfilment of intention unifying life as a whole (Hogenová, 2002). We are accessible to ourselves only

during the performance of life, in existence. Existence is a vital movement about which three vital movements of Jan Patočka give evidence. They are three types of existence that differ in three referents where a referent is something that doesn't move but gives evidence about movement. A referent is the background of presence into figures, entrance into phenomenon; it is a horizon. Patočka distinguishes three referents: home, Earth in the sense of Gaia and an absolute situation. According to Hogenová we are always on the way and the way always has a horizon, a referent. It depends on us whether we will be determined by the things on the way or whether we will achieve our self-transcendence via a horizon at the end of our paths. Janát (1991) characterises Patočka's third vital movement as self-transcendence. It is a temperamentally determined step, a metaphysical act by which one doesn't enter into some mystic transcendence but into a real society of beings that live eternal life in truth; as a life in resignation, life in non-egoistic submission to others, for others, to supremacy. The approaches of Patočka, Merleau-Ponty, and Hogenová define horizons against the background of which it is possible to study and handle the phenomenon of a human being's self-transcendence. They will be accentuated factors that will influence our further research oriented to the definition and diagnosis of the phenomenon of self-transcendence in the sphere of physical culture (specifically in sport).

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## FENOMÉN SEBEPŘESAHOVÁNÍ ČLOVĚKA – VÝCHODISKA A VZTAHY (SPOJITOST S OBLASTÍ TĚLESNÉ KULTURY) (Souhrn anglického textu)

Pojednání o fenoménu sebepřesahu člověka prezentuje zjevnou rozmanitost přístupů a teoretických vymezení tohoto fenoménu. Na základě východisek historických, filozofických, psychologických a sociologických se autor pokouší systematizovat poznatky a vytváří vlastní, prozatím dvojí strukturu fenoménu sebepřesahování. Daný fenomén je vhodné chápat v intencích strategie zvládání zátěžových situací (coping styles) jako jednu z možností konstruktivního přístupu k těmto situacím. Pro přesnější obsahové vymezení pojmu sebepřesahování autor doporučuje zvolit horizont či pozadí fenoménu, v tomto případě smysl života (vůle ke smyslu). Závěr práce tvoří charakteristika oblasti možného výskytu a budoucí diagnostiky fenoménu a tou je oblast tělesné kultury (sportu).

*Klíčová slova: fenomén, sebepřesahování, transcendence, sebetranscendence.*



## EVALUATION OF JOB STRESS FACTORS (ORGANIZATIONAL AND MANAGERIAL) AMONG HEADS OF PHYSICAL EDUCATION ORGANIZATIONS

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At the beginning of the 21<sup>st</sup> century, although there were advances in technology and facilities for organizational affairs, the more complex role of managers and the necessity of possessing various skills have resulted in an increase in job stress among managers. The purpose of this research project was to evaluate all job stress factors at two levels: organizational (over 7 factors) and managerial (over 8 factors). Also, the relations between parameters such as age, gender, education level, records of service, etc. and all other factors were evaluated. The Spielberger standard questionnaire was completed by 91 physical education organization managers and the data was analyzed using descriptive statistics and the non-parametric test of the Spearman correlation coefficient, the Mann-Whitney and Wilcoxon tests, the Alpha Cronbach correlation coefficient and the Regression equation. The results indicate that there is a meaningful correlation between organizational job stress and managerial job stress ( $p < 0.001$ ). Factors such as bonuses and development of human resources were among the most intensive organizational job stress factors while factors such as maximum pressure for work quality, job importance and time pressure were among the most intensive managerial job stress factors. There was no meaningful relation between the above personal characteristics and organizational job stress, managerial job stress, and total stress types ( $p > 0.05$ ).

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*Keywords: job stress, macro stress (organizational), micro stress (managerial), managers of physical education organizations.*

### INTRODUCTION

On the evolutionary path of managerial methods, researchers first paid attention to the development of production methods and second to the design of organizationally appropriate structures, job redesign and corrections (Gareth, 1991). But they understood very soon that none of the above sources are as valuable and important as human power and that this power is necessary (Hersy & Blanchard, 1988).

Today, human power as the most valuable investment in the organization, presents many problems, and management experts and organizational psychologists are paying more attention to the factors influencing an increase or a reduction in human efficiency and trying to improve the influence of positive factors and reduce the role of negative ones by identifying them and taking necessary actions. One of these factors is job stress which has an unfavorable impact on each human's body and soul and also reduces their efficiency (Decenzo, 1988).

Decenzo (1988) reported that industries annually lose 5 billion \$ in England and 77 billion \$ in the U.S. for this reason.

Kenneley (1990) reported that job stress, especially chronic job stress, results in anxiety, fatigue and depression.

Two expressions, "depressed workers and depressed employees", were coined by Americans (1960 and 1970) for the first time. They understood in 1980 that the workers of all working classes feel nervous and this causes a lot of damage (Arnold & Feldman, 1988).

Kelley and Gill (1993) studied the relation between status variables (social support), personal variables (gender, records of service), and assessment (feeling stress and role contradiction), fatigue. There was a positive correlation between assessment variables of stress and fatigue. In another study, Davidson and Ohler (1992) probed the role of a reduction in job stress and anxiety and colleagues' support in fatigue reduction.

In the last two decades there has been an increase in job stress at various physical education organizations due to their important nature and duties so the stress has undergone study and evaluation. In this regard, Bradley (1993) and Lea and Loughman (1993) point to job dimensions and requirements, Physical Education heads' duties and responsibilities particularly regarding athletes. Desensi, Kelley, Blanton, and Beitel (1990) believe that considering the present situation, in the past 20 years physical education heads' duties have become more complex in various dimensions such as financial affairs, social relations, prepa-

ration for performance of urgent, quick and important tasks, power attraction, conformity with Parliament regulations and foreign investment attraction. Greenberg (1993) believes that the following items increase job stress: an increase in heads' responsibilities, the nature of changing, advanced and new sports and the necessity of athlete's preparation programs for competitions. So he suggests a descriptive model of job stress resulting from the following cases:

1. Stress factors of the job itself as the natural, attached ones.
2. Personal characteristics of an individual (manager).
3. Stress factors outside the organization like family and economic situations (Greenberg, 1993).

Vealey, Urday, Zimmerman, and Solidy (1992) reported that some Physical Education heads, contrary to an increase in their role and duties, face the pressure of coordination among duty amounts and variation and time. There is a meaningful correlation between job stress and an increase in duty amounts. Barry, Copeland, and Scottkirch (1995) conducted research on 108 Physical Education heads (National Institute for Inter-University Sports). The result was that there is an equal amount of job stress among the heads, and one of the common stress factors is the stress of having to earn a living.

Ivancevich, Matteson, and Dorni (1988) in their study tried to investigate specific stress factors playing a role in special jobs. In this research project there are 17 job stress factors in 2 collections (organizational job stress and managerial-individual job stress).

In this regard, Donyl and Chuck (1993) in his research evaluated organizational and managerial-individual stress factors at Physical Education Faculties.

Since the intensity of job stress is one of the determining factors in quantitative and qualitative reduction of human efficiency, this research tries, by utilizing the most recent related, scientific information, to perform a comprehensive study on the amount of job stress among physical education organization heads and on determining the effect of each factor, and to present them in 2 collections (organizational job stress and managerial-individual job stress). Organizational job stress includes the organizational structure of human resources development, work trends, management methods, power use, cooperation, and managerial job stress includes the high pressure of work quality and importance, time pressure, the high pressure of the amount of work, job-related technology, improvement and promotion, stress contradiction, role ambiguity and responsibility against staff performance. Furthermore, the evaluated factors in this research are age, gender, education level, total records of service and records of service at the present job.

We hope to provide a program to omit destructive factors and make a suitable organizational environment to utilize the most important investment of or-

ganization (human power) as well as to respect humans' dignity by identifying the amount of job stress and its major factors in any physical education organization.

## RESEARCH METHOD

The field method was used in this research project. In other words, the descriptive method is considered in general. Five statistical researched communities include physical education organization managers (all major managers in a Management Center, five Managerial and Financial Deputies, Sport Affairs and Technical Deputy, Legal Deputy, Parliament and Province Affairs, Cultural and Educational Deputy, Women's Sports Deputy, all heads of the physical education organization of Iran provinces and their deputies, heads of selected sport federations, some of the selected experts with managerial careers). Of 123 questionnaires which were distributed, 91 questionnaires, after subtracting incomplete questionnaires, were filled out completely and turned back in. The Spielberger job stress questionnaire was used whose first section consisted of 30 questions about 30 job stress events and was presented in a disciplinary and structural way. In the second section, job stress questions were in non-structured form. There is a meaningful correlation between this questionnaire and that of the Lazarus and Cooper study of stress.

The internal appropriateness of the Spielberger job stress questionnaire was evaluated at about 90% in comparison with that of Westbury, Grier, and Green Field's questionnaires (Marelli, Waters, & Martelli, 1989).

To determine the reliability of the questions, with a pilot study and the questionnaires distributed over a 45-day interval, there was a pre-test among 25 selected managers. There was a meaningful correlation among the stress questions in  $p < 0.001$  level based on Alpha Cronbach correlation coefficient and with ( $r = 0.873$ ).

It is worth mentioning that in addition to the above information, there was a study on personal characteristics of managers such as age, marital status, education level, field of study, total records of service and records of service in the present job, and their relations to types of job stress were evaluated. In this research, the resulting data was evaluated by descriptive statistics. Non-parametric tests, the "Spearman correlation coefficient", "Mann-Whitney test", "Wilcoxon test", "Kruskal-Wallis test", "Alpha Cronbach correlation coefficient" and "Regression equation" were used to analyze assumptions due to their qualitative nature and so not being suitable for parametric tests.

First, there will be a glance at all the factors causing organizational job stress and then managerial job stress using descriptive statistics. Then we will analyze the research questions using inferential statistics.



## Organizational job stress

**TABLE 1**

All organizational job stress factors by rank in physical education organization heads

The intensity of managerial job stress factors by rank					
No.	Organization job stress factors	Average	Criterion deviation	Intensity mode	Deviation from total average
1	Bonus	6.11	1.70	7	+0.77
2	Development of human resources	6.05	2.50	9	+0.71
3	Organizational structure	5.50	2.50	5	+0.16
4	Work trend	5.01	1.63	4	-0.33
5	Minimum use of power	4.93	2.19	5	-0.41
6	Cooperation	4.89	2.23	7	-0.45
7	Management method	4.75	1.82	6	-0.59
86 managers; 2 managers omitted					
The average of total organizational job stress factors = 5.34					

In the above table, the bonus factor has the maximum intensity among organizational job stress factors and this shows a weakness in cases such as logical relation between job and bonus, praising good work, and sufficient salary. The second factor regarding stress intensity is the development of human resources. It shows a weakness in the development of colleagues and employees' capabilities and sometimes their lack of responsibility. It is clear that sufficient attention should be paid to the above factors in order to have

a better organizational environment and reduce job stress. Contrary to the above factors, management method and cooperation cause the minimum stress intensity.

## Managerial job stress

In TABLE 2, maximum pressure of work quality and importance are the most important factors causing managerial job stress among physical education organization managers and it shows that the managers

**TABLE 2**

All managerial job stress factors among physical education organization heads by rank

The intensity of managerial job stress factors by rank					
No.	Organizational job stress factors	Average	Criterion deviation	Intensity mode	Deviation from total average
1	Maximum pressure of quality & work importance	5.24	2.61	8	+0.52
2	Time pressure	5.07	1.73	7	+0.35
3	Maximum pressure of work amount	4.93	2.07	5	+0.21
4	Technology related to job	4.87	1.80	6	+0.15
5	Development & promotion	4.70	1.91	4	-0.02
6	Role contradiction	4.37	1.56	5	-0.35
7	Responsibility against employees' acts	4.27	2.06	4	-0.45
8	Role ambiguity	4.21	2.23	2	-0.51
86 managers; 2 managers omitted					
The average of total organizational job stress factors = 4.72					

**TABLE 3**

Analytic table of organizational job stress and managerial job stress among physical education organization managers

Job stress			Statistic amount	Managerial job stress		
Average	Criterion deviation	No. of managers		Average	Criterion deviation	No. of managers
5.34	1.34	85 omitted	$r = 0.486$	4.72	1.29	86 omitted = 2
The relation is confirmed with a certainty of more than 99 in 1000 $p < 0.001$						

face critical situations. This factor depends on a high level of skills and abilities. The second factor regarding job stress intensity is time pressure. The time factor comes under consideration when the manager should make suitable and important decisions on urgent affairs in a minimum period. The above factor can be justified by considering the physical education job to be one presenting many critical and urgent situations.

#### The relation between managerial and organizational job stress

Analytic TABLE 3 shows the evaluation of the relation between managerial job stress and organizational job stress among physical education organization managers.

In the above table, it is confirmed that there is a linear and meaningful relation between organizational and managerial job stress among physical education organization managers with an error probability of less than 0.01 (Spearman correlation coefficient)<sup>1</sup>. The above assumption confirms that all stress factors, both those rooted in behavior and related to managers' acts and those rooted in the organization having such an organizational base and structure, are the subsets of a total structure and show symmetrical changes. Maybe this fact has a special practical value for high-ranking managers in the organization, because it provides a chance for them to alleviate or balance factors causing the maximum intensity stress (both organizational and managerial). Now, if there are no conditions and facilities in the organization to alleviate

**TABLE 4**

Analytic table of relations among all organizational job stress factors in physical education organizational managers

Stress factors	Bonus	Management method	Work trend	Development of human resources	Cooperation	Minimum use of power	Organizational structure
Bonus		**			**		
	1.000	0.5321	0.2459	0.1833	0.4396	0.2192	0.0042
Management method	**		**	*	**	**	*
	5.321	1.000	0.6002	0.2899	0.4396	0.4788	0.3335
Work trend		**		*	**	**	*
	0.2459	0.6002	1.000	0.3213	0.4595	0.7757	0.2759
Development of human resources		**	*		**	*	*
	0.1833	0.2899	0.3213	1.000	0.5324	0.3002	0.2698
Cooperation	**	**	**	**		**	
	0.4396	0.4396	0.4595	0.5324	1.000	0.3828	0.2521
Minimum use of power management		**	**	*	**		*
	0.2192	0.4788	0.7757	0.3002	0.3828	1.000	0.2698
Organizational structure management		*	*	*	**	*	
	0.0042	0.3335	0.2759	0.2698	0.2521	0.2698	1.000

\* ( $p < 0.05$ ) \*\* ( $p < 0.01$ )

<sup>1</sup> As the data is qualitative and not suitable for parametric testing, the non-parametric test of Spearman correlation coefficient was used.

**TABLE 5**

Analytic table of relations among all managerial job stress factors among physical education organization managers

Stress factors	Role contradiction	Pressure of work amount	Growth trend	Time pressure	Job technology	Role ambiguity	Quality & importance	Responsibility
Role contradiction	1.000	* 0.3045	* 0.2643	** 0.3566	** 0.3490	* 0.3059	** 0.4476	** 0.3413
Pressure of work amount	* 0.3045	1.000	0.1567	** 0.5364	** 0.3436	0.1638	** 0.4292	** 0.8565
Growth trend	* 0.2643	0.1567	1.000	0.1511	** 0.3784	** 0.4010	0.2454	0.1781
Time pressure	** 0.3566	** 0.5364	0.1511	1.000	0.2119	* 0.3104	** 0.4416	** 0.4402
Job technology	** 0.3490	** 0.3436	** 0.3784	0.2119	1.000	* 0.3167	* 0.2868	0.1738
Role ambiguity	* 0.3059	0.1638	** 0.4010	* 0.3104	* 0.3167	1.000	** 0.4677	** 0.3541
Quality & importance	** 0.4476	** 0.4292	0.1781	** 0.4416	* 0.2868	0.4677	1.000	** 0.4537
Responsibility	** 0.3413	** 0.8565	0.4010	** 0.4402	** 0.3541	0.1738	** 0.4537	1.000

\*( $p < 0.05$ ) \*\*( $p < 0.01$ )

a factor, one can reduce the stress average by a reduction in other factors which can be alleviated in the organization and make a better work environment.

As each organization has special managerial characteristics and organizational requirements, the relations among all organizational job stress factors were evaluated to make the resulting data operative and to utilize them executively (TABLE 4).

In the above table, physical education organization managers can alleviate stress factors relating to some more. TABLE 5, also like TABLE 4, shows the relations among all managerial job stress factors.

The summary of TABLE 4, 5 relations will be presented in our Argument. In this research project, the relations of all organizational and managerial stress factors were evaluated, but they are not presented here for the sake of brevity.

In the above table, the average of organizational job stress is higher than managerial job stress. So it is better to pay attention to organizational stress factors which demand a glance at organizational structure.

The factors having minimum organizational stress, were reported to be management method and cooperation. Those having minimum managerial stress, were role ambiguity and responsibility against employees' acts.

### Managers' characteristics

There is an answer in TABLE 6 to the question as to whether there is a meaningful relation between the personal characteristics of managers (age, marital status, level of education, total records of service, records of service in their present job, relation between education field and present job), and types of job stress.

The research data show that the average of managers' ages are 43/45. Although the maximum relation exists between managerial job stress and age, none of the above cases had meaningful relations ( $p > 0.01$ ).

Regarding the test<sup>2</sup>, marital status should be mentioned, although the job stress of married managers is twice as much as that of single ones. But this difference did not reach a meaningful level ( $p > 0.05$ ).

Managers' level of education was evaluated at 6 levels:

Of the managers, 37.1 % have less than a BA and 62.9 % have a BA and higher education. According to the test, there was no meaningful difference between types of job stress and various levels of education among managers ( $p > 0.05$ ).

Managers' total records of service means all the years of service since the beginning of their job in the organization and records of service in present job means the period in which managers work at the

<sup>2</sup> The non-parametric test of Mann-Whitney is used to compare the ranked, qualitative variable of job stress and nominating variable of marital status.

**TABLE 6**

Analytic table comparing personal characteristics and types of job stress in physical education organization managers

Job stress							Managers' characteristics
Test type	Test result	Job stress	Managerial job stress	Organizational job stress	Average		
Non-parametric							
–	–	4.988	4.717	5.341	–	Average	
Pearson correlation coefficient	$p > 0.01$	$r = 0.0808$	$r = 0.1070$	$r = 0.235$	43.45	Age	
Mann-Whitney	$p > 0.05$	$z = -0.5266$	$z = -1.1652$	$z = -1.1023$	–	Marital status	
Kruskal-Wallis	$p > 0.05$	$\chi^2 = 2.6813$	$\chi^2 = 2.8629$	$\chi^2 = 2.3228$	–	Education level	
Pearson correlation coefficient	$p > 0.01$	$r = 0.0196$	$r = -0.0431$	$r = -0.0157$	23	Total records of service	
Pearson correlation coefficient	$p > 0.01$	$r = 0.0067$	$r = 0.0108$	$r = -0.0482$	7.96	Records of service at present job	
Mann-Whitney	$p < 0.05$	$z = -2.4193$	$z = -0.22716$	$z = -2.0235$	–	Job relation to education level	

present managerial job. There was no meaningful relation between 2 types of records of service and types of job stress based on Pearson correlation coefficient test ( $p > 0.05$ ).

Of physical education organization managers, 73.1 % had jobs related to their field of study and 26.9 % did not have a related job. There was a meaningful difference among managers' job stress regarding field of study based on Mann-Whitney test ( $p > 0.05$ ).

### Argument and conclusion

This research provided a chance to identify major factors of organizational job stress in the organization under research. Among physical education organization managers, these factors, ranking in accordance to their intensity, are as follows: bonus, development of human resources, organizational structure, work trend, minimum use of power, cooperation and management method. The maximum average of intensity was associated with bonuses (6.11) and the minimum average was associated with management methods (4.75).

Considering the intensity and the stress amount of the above factors in the organization, the high-ranking managers, specially those who try to design the organizational structure, can alleviate and balance them with minimum time and expense. Carry Coopler's research specified the job stress factors in 10 countries including England, Sweden, Germany, Japan, Singapore, The U.S., Nigeria, South Africa, Brazil and Egypt. The most intensive factor was "workers without sufficient

education" among the organizational job stress ones which shows a lack of development in human resources.

These research data are in conformity with Saleh and Desai (1986) research on engineers' community and also with Smeltzer (1987) research in Nelson, Quick, and Hitt (1989) private and public institute. Many specified bonuses, maximum pressure of work and time pressure as the most important job stress factors among high school managers. Schucker (1984) reported the same results on the nurses of California Hospital. Lea and Loughman (1993) specified the job requirements (organizational stress) as growing ones. The results and model of this research are in conformity with that of Donyl and Chuck (1993) and Greenberg (1993) and it is different from Hartman's (1981) research results.

The results of a study on the relation among various factors of organizational stress among physical education organization managers are as follows: There is a linear, meaningful relation between bonuses and management methods, cooperation in ( $p < 0.001$ ) level. This is true between management methods and work trends, development of human resources, cooperation, the minimum use or powers in ( $p < 0.001$ ) level- between management method and organizational structure in ( $p < 0.001$ ) level- between work trends and management methods, cooperation, minimum use power in ( $p < 0.001$ ) level- between work trends and development of human resources, organizational structure in ( $p < 0.01$ ) level. In addition to the above relations, there is a meaningful relation

between the development of human resources and cooperation, the minimum use of power, and organizational structure in ( $p < 0.01$ ) level. The above information provides a chance for physical education organization managers to consider the related factors more precisely and utilize the available facilities to alleviate or balance them and so reduce the stress average of managers.

### **Managerial job stress**

Considering the results of the managerial job stress factors, the major ones based on intensity order among physical education organization managers are as follows:

Maximum pressure of work quality & importance, time pressure, maximum pressure of work amount, technology related to work, development and promotion trend, role ambiguity, responsibility against employees' acts and finally role ambiguity. The most intensive stress, with the average of 5.24, was minimum pressure of work quality and importance. The least intensive stress, with the average of 4.21, was role ambiguity.

### **The role of organization high-ranking managers**

As mentioned before, the most intensive stresses were maximum pressure of work quality and importance and time pressure in physical education organization. This means that management duties of the organization require a high level of skill and the manager faces critical situations. On the other side, considering time pressure, some cases are urgent and they require quick decisions about important situations and in a minimum period. Considering the intensity and preferences of each managerial stress factor, high-ranking managers in the organization can program and act accordingly to alleviate and balance them by minimum time and resources. For each factor, they should take its practical concept and role in reaching the organizational into consideration.

### **Managers' characteristics**

There was no meaningful relation between stress types and age, studying the age whose increase caused job stress reduction in some cases ( $p < 0.01$ ).

The data is in conformity with the research results on the medical staff of Shiraz Hospital (specially the nursing staff) in 1984, but it is contrary to that of McQuigg (1992). They believe that there is a meaningful difference in stress among various ages and young people have more stress. Dodson and Rogers (1988) evaluated the job stress using Maslach questionnaire and found a meaningful difference among various ages. There was no meaningful difference among physical education organization staff in Donyl and Chuck's study (1993).

Regarding marital status, although the average job stress among married managers were twice as much as the single ones, there was no meaningful difference

( $p < 0.05$ ) perhaps due to the small numbers of single managers as samples (4 people) (Mann-Whitney test).

The same results were found in Donyl and Chuck's and Mr. Keshavarz' research projects (1993). These results are contrary to that of Golembewski, Munzenrider, and Stevenson (1986). Managers have more stress during the development of their education level. The average of 23.5 is reported to be for levels without a diploma and 46.10 to be for MA and higher. Perhaps an increase in stress intensity in managers with high levels of education is due to undertaking important jobs with many duties in the organization and the jobs require complicated tasks and performance of important and hazardous duties. Nevertheless, there was no meaningful relation among various levels of education ( $p < 0.05$ ). In the Kruskal-Wallis test, the lack of a meaningful relation between total records of service, records of service in the present job and job stress ( $p < 0.05$ ) (Pearson correlation coefficient), contrary to the expectation that job stress reduces as records of service increase, perhaps shows that due to duty and responsibility increase, holding important jobs, an increase in records of service and more stress, there is no reduction in stress in the research statistical community.

### **Suggestions**

We hope that physical education authorities can utilize the results of this research and that the results can play a small role in making the organizational environment better and respecting the dignity of human resources in the organization. On the other hand, as the research was performed on physical education organization managers, it can not be generalized to other Iranian executive organizations. So it is suggested to perform this research in other organizations to provide the job stress fluctuation of Iranian managers.

Moreover, the following items are suggested for future researches:

- the study and analysis of organizational job stress in an independent research project,
- study and analysis of managerial job stress in an independent research project,
- study and analysis of making a better environment to reduce managerial and organizational job stress,
- study of job stress effects on managers' job efficiency and productivity in organizations,
- study the effect of stress managerial education on the reduction of job stress,
- study of the effect of various social, cultural and economic factors on organizational managers' stress amount, anxiety and fatigue,
- study of the effect of job stress and anxiety factors on organizational employees' efficiency,
- comparison of managerial and organizational job stress of managers and employees,
- comparison of managerial and organizational job stress of service, production, cultural and educational organizations.

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## VYHODNOCENÍ FAKTORŮ PRACOVNÍHO STRESU (ORGANIZAČNÍHO A MANAŽERSKÉHO) MEZI VEDOUCÍMI ČINITELI TĚLOVÝCHOVNÝCH ORGANIZACÍ (Souhrn anglického textu)

Přestože na začátku 21. století nastal pokrok v technologiích a materiálním vybavení, komplexnější role manažerů a nezbytnost využívat množství dovedností ústí ve zvyšující se pracovní stres. Účelem tohoto výzkumu bylo vyhodnotit všechny pracovní stresory, a to na dvou úrovních: organizační (více než 7 faktorů) a manažerské (více než 8 faktorů). Vyhodnocovány byly rovněž vztahy mezi všemi faktory a parametry jako jsou věk, pohlaví, úroveň vzdělání, záznamy o praxi atd. 91 manažerů z tělovýchovných organizací vyplnilo Spielbergův standardní dotazník a data byla analyzována za použití popisné statistiky a neparametrických testů: Spearmanova korelačního koeficientu, testů Mann-Whitneyho a Wilcoxonova, Cronbachova korelačního koeficientu Alpha a regresní rovnice. Výsledky ukázaly, že existuje statisticky významná korelace mezi pracovním stresem

organizačním a manažerským ( $p < 0.001$ ). Faktory, jako jsou odměny a rozvoj lidských zdrojů byly považovány za jedny z nejsilnějších faktorů organizačního pracovního stresu, zatímco faktory jako maximální nároky na kvalitní práci, důležitost zaměstnání a časová tíseň patřily mezi nejsilnější příčiny pracovního stresu manažerského. Nebyl zjištěn žádný signifikantní vztah mezi výše zmíněnými

osobnostními charakteristikami, organizačním pracovním stresem, manažerským pracovním stresem a celkovým stresem ( $p > 0.05$ ).

*Klíčová slova: pracovní stres, makrostres (organizační), mikrostres (manažerský), manažeři tělovýchovných organizací.*





## ANALYSIS OF THE SITTING-TO-STANDING MOVEMENT IN VARIOUSLY DEMANDING POSTURAL SITUATIONS

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This study is focused on the analysis of the sitting-to-standing movement (further stsm) in three variously demanding postural situations – spontaneous sitting-to-standing (I), sitting-to-standing with the elimination of visual control (II), and sitting-to-standing with modified proprioception from the lower limbs (III). A total of 21 young healthy women were examined their mean age was  $24 \pm 4$ . The analysis was carried out by means of the 3D videographic examination method. The differences between sitting-to-standing III and stsm I and II reached a statistically significant level. Increasing postural demands prolongs the total duration of the task in these three variations and changes the proportional time ratios of individual phases of the sitting-to-standing action. The results show that the highest demands are made on the body in the stsm with modified proprioception from the lower limbs. Elimination of sight affects the stsm to a lesser degree than modified proprioception.

*Keywords: sitting-to-standing, 3D videographic method, postural control.*

### INTRODUCTION

Rising from a sitting position is one of the most common daily activities. The ability to rise from a sitting position is an essential component of many daily actions, and belongs among the basic skills that enable an individual to lead an independent life. Rising from a sitting position is taken as one of the most difficult and mechanically demanding functional operations facing an individual in the course of a day. Kerr et al. (1994, 1997) regards rising from the sitting position as a functional ability that is one of the basic prerequisites for walking. If the standing position is to be regarded as fully functional (for example, for reaching an object placed in a higher position), an individual must be able to independently rise from a sitting position (Bajd & Kralj, 1982). Without the ability to rise from a sitting position, many patients and older people would be limited in this postural situation, and would lose their independence.

As with walking, the main joint movement patterns while rising from a sitting position have the character of stereotypes, even though there is, in this case, a high degree of differentiation, dependent mainly on the initial position of the feet and the height of the particular chair. For this reason it is possible to conclude that rising from a low chair will require far greater movement in the lower limb joints and a higher total exertion of strength (Trew & Everett, 1997).

In addition to the range of movement in the hip, knee, and ankle joints, additional significant independent factors for the sitting-to-standing skill are

visual sensitivity, proprioception in the lower extremities, distal tactile perception, body weight, pain, anxiety, and physical fitness (Lord et al., 2002).

Our study addressed standing from a sitting position in three modeled situations. Our goal was to determine the effect of the absence of visual control and altered proprioceptive information during this demanding postural activity, using 3D video-graphic analysis. Sensory changes were made in the modeled situations, and on the basis of the results we evaluated the significance of the loss of the mentioned stimulation for the individuals. The study was conducted under highly standardized conditions, thereby enabling comparison with previous studies, as well as those with a further connection to this work.

In each tested individual we analyzed the sitting to standing positions with and without visual controls, as well as with altered proprioceptive information by means of sensory-motor sandals (Fig. 3).

### METHODOLOGY

The study was conducted on a group of 21 subjects, aged  $24 \pm 4$  years. The group of subjects included only healthy women, without acute or chronic problems of the muscular-skeletal system. There were no neurological, visual, or vestibular defects in their case histories. Static (sitting) activity was predominant in their daily routines. The height range in the subjects was  $168.5 \pm 11.5$  cm, body weight was  $61 \pm 15$  kg.

All evaluated subjects were familiarized with the course of the study and agreed with having the results

used for research purposes. The tested group was considered to be representative of a healthy population of women in the given age category.

Following the completion of anamneses (medical histories) and kineziological analyses, the body of each subject had 12 black contrasting body markers in the following locations:

- Capitulum ossis metatarsalis quinti l. sin.
- Malleolus lateralis l. sin.
- Condylus lateralis femoris l. sin.
- Trochanter major femoris l. sin.
- Acromion l. sin.
- Processus spinosus L5.
- Processus spinosus L1.
- Processus spinosus Th5.
- Processus spinosus C7.
- Tragus l. sin.
- Arcus zygomaticus l. sin., at the midpoint between the tragus and the base of the orbit (Frankfort plane – as Nuzik et al. described in their study, 1986).
- The vertices of the heads of all subjects were marked for the processing of data for the 3-D motion analysis.

The subjects were allowed a spontaneous speed for rising from a sitting position, and for turning of the head within the conducted movement. They were not allowed to simplify the movement by support of the upper extremities. The spontaneous method of rising from the sitting position was marked stsm I. In the tests with the absence of vision (stsm II) the subjects were required to keep their eyes closed. For rising from the sitting position with the sensory-motor sandals (stsm III) the test group was asked to stand on the "ball" and tips of the sandals. Schenkman's (1990) method of division was chosen for the categorization of the stsm action into individual phases.

The camera positions for the 3-D videographic analysis are shown in Fig. 4. The synchronization of the recordings from the individual cameras was obtained by using three synchronization panels developed in the Department of Biomechanics and Engineering Cybernetics, FPC UP, Olomouc and 3-D kinematic motion analysis was performed using the Ariel Performance Analysis System.

Our study tracked and evaluated the following parameters:

- Total rising time.
- Proportional representation of the individual phases of momentum transfer during the stsm activity.
- Trajectory of processus spinosus C7 in individual situations during the stsm activity.
- Extent of the movement range in the designated joint segments Th5-C7 and C7-vertex, in particular the flexion and extension of the cervical spine.

The data was statistically processed using the Statgraphics program. The following statistical parameters were also followed in each type of stsm activity: arithmetic mean, standard deviation, minimum and

maximum. The nonparametric Wilcoxon test was used for comparisons between individual modifications of the stsm activity.

## RESULTS

The kinematic analysis of the data obtained from individual types of the stsm action enabled us to evaluate specific movement moments of the observed body parts; it also enabled us to identify time characteristics. After transforming the monitored points into a trajectory, emphasis was placed on the correct evaluation of linear and angular changes of the direction and slope of the trajectory. From the twelve contrasting body markers which we were following in the tested individuals, we obtained numerical data of relative and absolute values for the movement changes of the torso, the C7 trajectory, and the angular changes of the movement of the head and hip joints.

### Total rising time

The beginning was designated as the first discernible movement of the tested individual (the first appreciable movement of the C7-L5 connection and the change of the angle in the hip joint) following a sound signal. The end of the total stsm motion was defined by the achievement of maximum extension in the hip joint, which was set by the connections condylus lateralis femoris – trochanter major and trochanter major – acromion, and by the absence of motion in the angle of the connections Th5-C7 and C7-vertex.

The time characteristics of the selected operations for the individual types of the stsm motion had a moderate rising tendency, with the type III stsm motion having the longest duration.

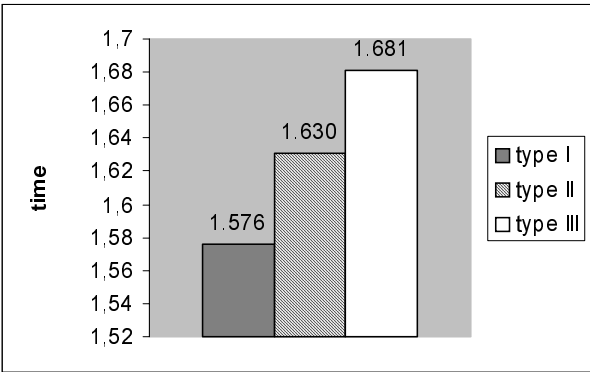
The total time for the type I stsm action (spontaneous stsm) was 1.58 s, for type II (stsm without visual controls) 1.63 s. For type III stsm (with altered proprioception in the lower extremities) there was an average total time of 1.68 s.

The differences between individually measured values did not reach the level of statistical significance (TABLE 1, Fig. 1).

### Proportional representation of the motion transfer phases

Schenkman (1990), Roebroek (1994), Jeng et al. (1990), Trew & Everett (1997), and Nuzik et al. (1986) divide motion into 2 phases: flexion and extension. For the purposes of our study we defined 3 phases; the extension phase was further divided into a phase for the transfer of movement, and an independent extension phase. The beginning of the flexion phase is determined by the first discernible movement of the C7-L5 connection and by the angle change in the hip joint. The end of this phase and the beginning of the transfer phase is determined by the first change in the size of the angle in the knee joint together with the beginning of movement in the hip joint, both in the vertical and horizontal direction. The end of the transfer

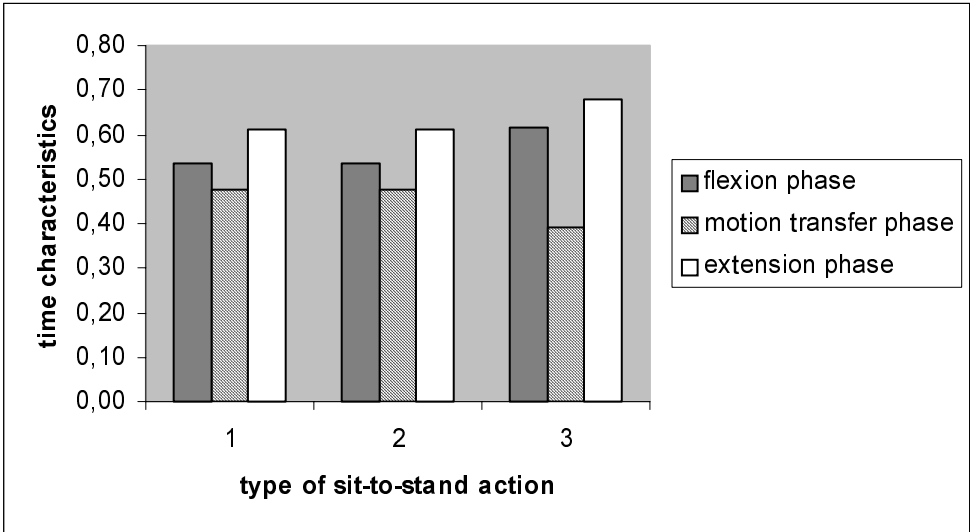
**Fig. 1**  
Total movement time during sit-to-stand action



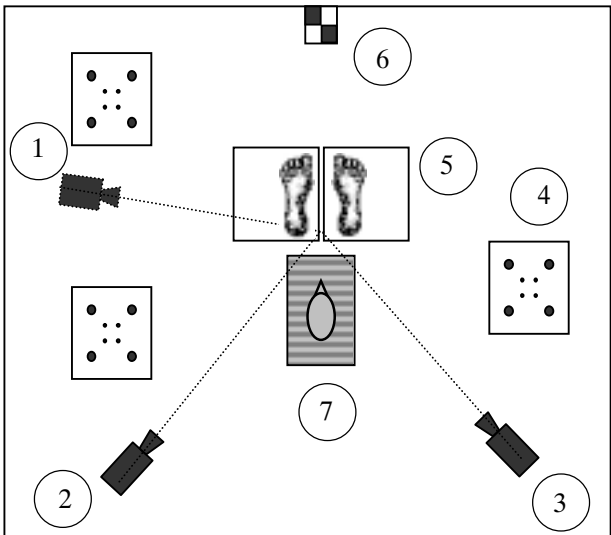
**Fig. 3**  
Sensory-motor sandals used for the type III sit-to-stand task



**Fig. 2**  
Proportional representation of individual phases in sit-to-stand action



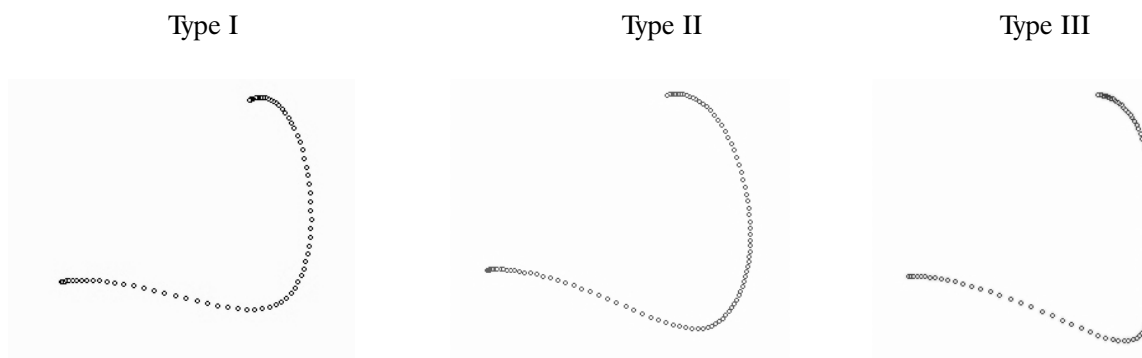
**Fig. 4**  
Graphic scheme of the monitored space for the 3D analysis of sit-to- stand action



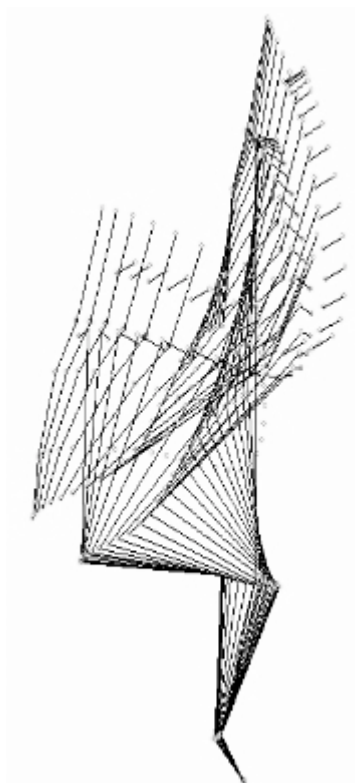
- 1 – camera number 1
- 2 – camera number 2
- 3 – camera number 3
- 4 – synchronization panels
- 5 – force platforms
- 6 – orientation point
- 7 – chair with adjustable height of the seat

**Fig. 5**

Movement of the processus spinosus C7 trajectory during individual sit-to-stand actions

**Fig. 6**

Kinogram of the 3D analysis of sit-to-stand action



phase and the beginning of the extension phase was determined by the maximum angle of the dorsal flexion of shank in relation to the horizontal plane formed by the mat on which the test subject was standing, as in Roebroek (1994) and Riley (1991). The end of the extension phase is given as the maximum extension reached in the hip joint. For the purposes of our study we transformed the length of the individual stsm phases into their proportional representation of the entire performed motion.

The average length of the motion transfer phase for type I stsm was 29.4 %, for type II the proportional representation of the motion transfer was 29.8 %, and for type III, 23.4 %. A comparison of the individual types of the stsm action shows that in type III there is

a shortening of the motion transfer phase and a corresponding protraction of the flexion phase, and an even more significant protraction of the extension phase. (TABLE 1, Fig. 2)

#### Processus spinosus C7 trajectory (TABLE 2, Fig. 5)

The trajectory was followed on both axis Y (C7 movement upward) and axis Z (C7 forward-backward movement). The evaluation of value deviations of processus spinosus C7 in relation to the anterior-posterior axis of movement between type I and type III stsm showed the level of statistical significance  $p < 0.05$ , and between type II and type III  $p < 0.001$ .

The differences between the lengths of the processus spinosus C7 trajectories in the individual stsm types were also followed. Studying the shape of the C7 trajectory in individual stsm types we discovered that the C7 trajectory for type III has the sharpest angle, and also the longest. According to statistical evaluation of the data, the differences between type I and type III stsm reached a statistical level of significance of  $p = 0.002$ ; between type II and type III  $p < 0.001$ . No level of statistical significance was found between the values of type I and type II stsm. We can therefore assert that the type III stsm action is the most strenuous.

#### Movement range in the joint of segment Th5-C7 and C7-vertex, specifically the flexion and extension of the cervical spine (TABLE 3)

The movement range in the angle of the vertex-C7 and C7-Th5 segments was 37° in type I stsm, 39° in type II, and 40° in type III. No statistical significance was determined between the individual stsm types concerning the movement of the head in respect to the upper thoracic spine. This can be connected to the compensatory kyphosis of the spine during movement.

#### DISCUSSION

In order to determine the total duration of the stsm action it is necessary to precisely identify the beginning and end of the motion. This matter has been a concern of many previous studies, the authors of

**TABLE 1**

Time domains for the sit-to-stand action

Time domains	Type I				Type II				Type III			
	$\bar{x}$	SD	min.	max.	$\bar{x}$	SD	min.	max.	$\bar{x}$	SD	min.	max.
flex.	0.534	0.131	0.340	0.980	0.536	0.158	0.320	0.920	0.615	0.152	0.420	0.960
transfer	0.467	0.155	0.260	0.820	0.477	0.186	0.220	1.000	0.389	0.108	0.220	0.680
extension	0.575	0.128	0.360	0.880	0.613	0.179	0.180	1.020	0.678	0.147	0.460	1.080
total	1.576	0.207	1.280	1.940	1.630	0.294	1.240	2.400	1.681	0.267	1.360	2.320
flx%	33.9	0.066	20.3	50.5	32.9	0.074	20.4	50.0	36.4	0.057	25.9	49.3
transf.%	29.4	0.083	17.6	51.9	29.8	0.105	14.5	63.3	23.4	0.055	14.4	32.9
ext%	36.7	0.079	22.8	59.5	37.6	0.082	11.4	52.0	40.4	0.066	30.4	54.3

Type I – spontaneous sit-to-stand

Type II – sit-to-stand with eliminated vision control

Type III – sit-to-stand with modified proprioception from the lower limbs

flex. – duration of the flexion phase of sit-to-stand (s)

transfer – duration of motion transfer phase (s)

extension – duration of extension phase (s)

total – total time of sit-to-stand action (s)

flx% – proportional representation of the flexion phase

transf.% – proportional representation of motion transfer phase

ext% – proportional representation of extension phase

 $\bar{x}$  – mean angular velocity during the movement

SD – standard deviation

min. – minimum. max. – maximum

**TABLE 2**

Results of the analysis of the processus spinosus C7 trajectory in cm (n = 21).

Trajectory C7	$\bar{x}$	SD	min.	max.
Type I	96.91	11.79	68.61	117.31
Type II	96.87	14.54	57.88	121.37
Type III	110.58	13.45	80.93	129.27

Type I – spontaneous sit-to-stand

Type II – sit-to-stand with eliminated vision control

Type III – sit-to-stand with modified proprioception from the lower limbs

 $\bar{x}$  – mean angular velocity during the movement

SD – standard deviation

min. – minimum. max. – maximum

**Table 3**

Movement range in specifically chosen joints during sit-to-stand action (n = 21)

Parameter	Type I				Type II				Type III			
	$\bar{x}$	SD	min.	max.	$\bar{x}$	SD	min.	max.	$\bar{x}$	SD	min.	max.
hip	106.33	8.73	92.85	122.38	106.23	7.70	89.45	120.10	114.81	9.93	99.24	132.04
knee	71.58	6.79	61.32	86.73	70.16	5.86	56.99	79.66	73.73	6.20	63.40	88.54
back	49.21	8.47	30.52	66.38	49.28	9.69	25.34	62.78	53.96	7.80	35.44	66.10
head	36.92	11.81	17.30	58.91	38.90	13.18	15.05	64.15	39.77	10.39	23.68	57.37

Type I – spontaneous sit-to-stand

Type II – sit-to-stand with eliminated vision control

Type III – sit-to-stand with modified proprioception from the lower limbs

hip – range of movement in the hip joint

knee – range of movement in the knee joint

back – range of movement of the segment C7 – L5 in regard to vertical

head – range of movement in the joint of segment Th5-C7 and C7-vertex

 $\bar{x}$  – mean angular velocity during the movement

SD – standard deviation

min. – minimum. max. – maximum

which have chosen various methods and followed different parameters in order to determine this specific time interval. Kerr et al. (1997) as well as Gross et al. (1998) identified the beginning of movement as consisting of the first changes in the linear movement of the torso. Mourey et al. (2000) similarly identified the beginning of the motion, but instead used as his parameter the increase of the angle speed of the torso, defined by the connection of the trochanter major and acromion in a vertical direction. They defined the end of the motion as the decrease of the angular speed below 10 % of the measured maximum. Khemlani et al. (1999) determined the beginning of movement according to the increase of the horizontal shoulder speed above 0.10 m/s; the end of movement was defined by the decrease of the horizontal speed of the indicated hip joint below 0.10 m/s. Magnan et al. (1996) as well as Roebroek et al. (1994) followed the center of mass (COM) in their studies. They therefore defined the beginning of motion as the primary change in the COM position, and the end of motion as the completion of COM movement in both the vertical and horizontal direction. In the studies used for our research the total time for the stsm varies from 1.3 to 2.5 seconds for the healthy population with a spontaneous speed of the performed task.

Our study came to similar conclusions. Due to the fact that the differences between the total duration of the stsm actions failed to reach the level of statistical significance we believe that minimal differences between individual types of the stsm action indicate an ability to compensate for sensory deprivation in our tested individuals, representing a sample of the healthy, young female population.

The question of precisely determining the beginning and end of the phase of motion transfer is considerably problematic. Different authors have used different methods for determining the beginning and end of this phase. With respect to the Kaucká study (1999), which preceded our work, we chose to define these phases according to Schenkman et al. (1990). The majority of authors agree on the length of the duration of the motion transfer phase in the range of 0.23 s–0.58 s, which is proportionally represented as 18–35 % of the total duration of the stsm action.

The resultant duration of the motion transfer phase in our study was comparable to the average values of other studies (Cheng et al., 1998; Kaucká, 1999; Mourey et al., 2000; Schenkman et al., 1990). We believe that the relatively shorter motion transfer phase in the type III stsm is due to a compensation mechanism for increasing stability. As was previously published in the works of Schenkman (1990) and Mourey (2000), this phase exhibits the greatest instability. According to the research of Cheng et al. (1998) this highly unstable phase is responsible for almost one third of the falls in stroke patients. We therefore conclude that the shortening of the transfer phase at the expense of the lengthening of both the flexion and extension phase was due to a movement control

mechanism intended to help in reaching a vertical position and minimize the risk of falling. From this it follows that the change in proprioceptive information from the lower extremities requires a much higher degree of movement control than in the case of the absence of spatial visual orientation. The differences between the values of the total duration of the stsm actions and the duration of the flexion and extension phases for type I and III approached the level of statistical significance. The same was found in the differences between the proportional representations of the flexion phases in comparing type II and III stsm actions. It is therefore possible that the differences between values could easily reach the level of statistical significance if the size of the test group were expanded.

The movement of the head during the stsm action is also connected to the position of the legs, hence to the degree of movement difficulty (Stevens et al., 1989). In this study the author emphasizes that the standardization of initial posture places a greater demand on muscle activity and excursions during head movement. Due to the fact that conditions for output are difficult, the organism automatically adjusts the position of the head and neck. It is known that receptors in the area of the cervical spine influence the posture of the entire body. Magnus (in Stevens et al., 1989) already showed in 1924 that the afferent effects from the cervical receptors, as well as in connection with labyrinth reflexes, are able to induce profound changes in the posture of the entire body. Scholz et al. (2001) was concerned with the variable movement of the head during variously demanding stsm actions (stretching the arms, constriction of the base of support with a simultaneous reduction of weight on the toes). From their conclusion it follows that normal (spontaneous position and speed) stsm action places the lowest demands on the range of head movement. Lindsey (1976, in Stevens, 1989) hypothesized that cervical receptors and the labyrinth system have equivalent roles in posture control. The difficulty of choosing the proper segment at which to follow the movement of the head during the stsm action (Nuzik et al., 1986), and the possibility of errors during the processing of data with marks placed closely to each other (Kaucká, 1999) led us to the decision to follow diverse segments. We therefore chose the angle between the Th5-C7 and C7-vertex segments for following the movement of the head. We discovered that determining the range of speed of head movement was more advantageous with regard to the thoracic spine than to the horizontal or vertical.

We were also concerned with the differences between the lengths of the processus spinosus trajectory paths among the individual stsm actions (Fig. 5). We were able to find only two references to studies of this trajectory in the stsm action in the available literature. Kaucká (1999) described a greater vertical distance of the C7 processus spinosus movement for individuals with LBP (lower back pain). The differences in the C7

trajectory projections during variably restricted stsm actions are apparent from the Stevens et al. (1989) study, where the longest trajectory path was reached during the stsm action with a standardized position of the lower extremities; the shortest was found in cases where the patient performed the action and could choose a preferred position of the lower limbs.

We compared the actual C7 movement projections in our test group and the individuals tested in the Stevens, et al. study. We came to the conclusion that an analogous curve describes the C7 processus spinosus in the type III stsm action in our study and the C7 during the stsm from a standardized initial position of the lower extremities, which Stevens identified as being the most demanding.

The majority of individuals, in the course of becoming familiar with the measuring, expressed fears of not being able to manage the type III stsm action with motor-sensory sandals. These fears were substantiated in only one tested individual, who, in her first attempt, had significant problems maintaining her balance in the extension phase of the movement. Instability compensation was managed by abduction of the upper extremities and a side-step mechanism. The second measured attempt was performed without stability corrective measures.

In comparing the total duration of the stsm actions within a specific individual, we came to the conclusion that the removal of visual controls caused a shortening of the total motion in the case of eight subjects. Six of these individuals suffered shortsightedness; this was corrected by dioptric aids. We believe that there is a connection between these two facts, perhaps for the reason that shortsighted individuals have learned, increased postural control in situations lacking 100 % visual information quality (periods when they are not using corrective lenses). In future studies it would be interesting to compare the postural reactions in the stsm action among a population of visually impaired individuals.

For a more precise and complex analysis of the stsm action in the future, we recommend an expansion of this study to include the results from dynamic movement analysis as well as an analysis of EMG data from several muscles chosen in the lower extremities.

## CONCLUSION

The total length of the stsm action was prolonged by the removal of visual controls. The modification of proprioceptive information from the lower extremities by means of motor-sensory sandals caused an additional lengthening of the action. However, due to the small size of the test group, the differences failed to reach the level of statistical significance.

The proportional representation of the motion transfer phase was nearly identical for the spontaneous stsm and the stsm with the removal of visual controls. The proprioceptive modification in the lower extremities using the motor-sensory sandals resulted

in a shortening of the motion transfer phase at the expense of the flexion and extension phases.

The torso movement range in the sagittal plane for the stsm action with the proprioceptive modification was statistically greater than for the spontaneous stsm and the stsm with the removal of visual controls.

Proprioceptive modification in the lower extremities during the stsm action led to a statistically significant increase in angle speed in the knee joint. The size of the angular velocity in the knee joint during the spontaneous stsm and the stsm with the removal of visual controls was nearly identical.

The size of the deviation in the C7-L5 connection was statistically more significant in the stsm action with the proprioceptive modification in the lower extremities than in the spontaneous stsm. The removal of visual controls in the stsm action had no effect on the deviation size of the C7-L5 connection in relation to the spontaneous performance of this action.

Regarding the statistical significance of the lengthening of the C7 processus spinosus trajectory, the following order represents the shortest to the longest trajectory: the spontaneous stsm, stsm with removal of visual controls, and stsm with proprioceptive modification from the lower extremities using motor-sensory sandals.

On the basis of our results it seems that motion analysis using the 3D videographic examination methods is an effective and reliable process for the study and analysis of the biomechanic aspects of the stsm action.

The results of the kinematic analysis of our test group show that the proprioceptive modification of the lower extremities places a greater demand on the performance of the action than does the removal of visual controls. We believe that for our test group proprioception played a greater role than visual controls in performing the action.

We further believe that the clinical application of the 3D videographic analysis of the stsm action could be one of the most effective accessory methods for diagnosing latent motion coordination disorders.

On the basis of the results and experience gained from our study we recommend using situations in which visual controls are removed. Proprioceptive modification plays a role in the process of motion reeducation.

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# ANALÝZA VSTÁVÁNÍ ZE SEDU PŘI POSTURÁLNĚ RŮZNĚ NÁROČNÝCH SITUACÍCH

(Souhrn anglického textu)

Vstávání ze sedu patří mezi mechanicky nejnáročnější funkční úkony, které člověk každodenně vykonává. Je jedním ze základních předpokladů pro chůzi a samostatnost jedince a vyžaduje vysokou míru posturální kontroly (Kerr et al., 1997).

V naší práci jsme se zaměřili na analýzu vstávání ze sedu při různě posturálně náročných situacích. Soubor testovaných jedinců tvořilo 21 zdravých mladých žen. Sledovali jsme jejich posturální chování při spontánním vstávání ze sedu, při vstávání ze sedu s vyřazením zrakové kontroly a při vstávání ze sedu s pozměněnou propioceptivní informací z dolních končetin (pomocí senzomotorických sandálů).

Výsledky ukazují na nejvyšší nároky na organizmus při vstávání ze sedu s pozměněnou propiocepcí z dolních končetin. Vyřazení zraku z kontroly pohybu ovlivňuje vstávání ze sedu, avšak menší mírou nežli změna propiocepce.

Analýza pohybu byla provedena pomocí 3D videografické metody. Metoda umožňuje hodnocení záznamu s časovým odstupem a porovnání parametrů mezi sebou. Ve spojení s EMG a dynamickou analýzou pohybu pomocí tensometrických plošin umožňuje 3D videografická metoda kvalitní hodnocení pohybu jako celku.

**Klíčová slova:** vstávání ze sedu, videografická vyšetřovací metoda, posturální kontrola pohybu.



# EARLY EFFECTS OF INPATIENT (PHASE I) AND OUTPATIENT (PHASE II) CARDIAC REHABILITATION IN PATIENTS WITH POST MYOCARDIAL INFARCTION AND SUBSEQUENT TREATMENT USING CORONARY ARTERY BYPASS GRAFTING OR CORONARY ARTERY STENT IMPLANTATION

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Along with the increasing number of coronary artery bypass grafting (CABG) or coronary artery stent implantation (CASI) patients, the problem of establishing an appropriate rehabilitation program for these two groups of patients arises. The objective of this study was to assess the level of exercise tolerance in post myocardial infarction (MI) patients treated surgically with one or the other of these two procedures, who were subjected to the proposed rehabilitation program. Two groups of male patients were investigated. The first one consisted of 24 patients, who underwent the CABG procedure; the second – of 24 patients, who underwent the CASI procedure. The assessment of exercise tolerance was performed on the basis of treadmill stress tests (according to Bruce's protocol). The test was first performed prior to the surgical procedures and then after completion of the proposed rehabilitation program consisting of two phases. In the CASI group the time and the covered distance of the stress test increased significantly after the procedure. The average metabolic cost increased significantly as well. In the CABG group the stress test time increased significantly, as did the covered distance, maximal HR, double product and the workload. Also the drop in the number of pathological reasons for the test termination was statistically relevant. The programme of rehabilitation used in the present study justified its efficacy, bringing about a considerable increase in exercise tolerance in both groups studied.

*Keywords: CABG, CASI, physical capacity, treadmill stress test.*

## INTRODUCTION

Surgical procedures in patients with post myocardial infarction (MI) have become a generally accepted and commonly performed method of treatment. Research conducted on coronary artery bypass grafting (CABG) patients has shown a considerable improvement of their clinical status. In the mid 1980's, a coronary artery stent implantation (CASI) procedure was introduced as an alternative to the CABG. Along with the increased number of CABG or CASI patients, the problem of establishing an appropriate rehabilitation program for these two groups of patients arose, and so did the problem of assessing its efficacy.

The objective of this study was to assess the level of exercise tolerance in patients, post MI treated surgically with the CABG or the CASI, who were subjected to the proposed rehabilitation program both during phase I and phase II of the treatment.

## MATERIALS AND METHODS

Two groups of male patients were subjected to this study. The first group studied consisted of 24 patients of 38–69 years of age ( $50.6 \pm 8.5$  years on average), who underwent the CABG procedure when they were

3 months post MI (CABG group). Those patients demonstrated stenosis of 3 coronary arteries or with an extensive area of ischaemia when fewer arteries were narrowed.

The second group studied consisted of 24 patients of 35–68 years of age ( $53.5 \pm 9.7$  years on average), who underwent a coronary stenting procedure when they were 4–6 weeks post MI (CASI group). That procedure was performed in patients who were diagnosed with stenosis of 1 or 2 coronary arteries, with a small area of ischaemia. Specific data concerning the number of implanted stents and grafted bypasses is shown in Fig. 1.

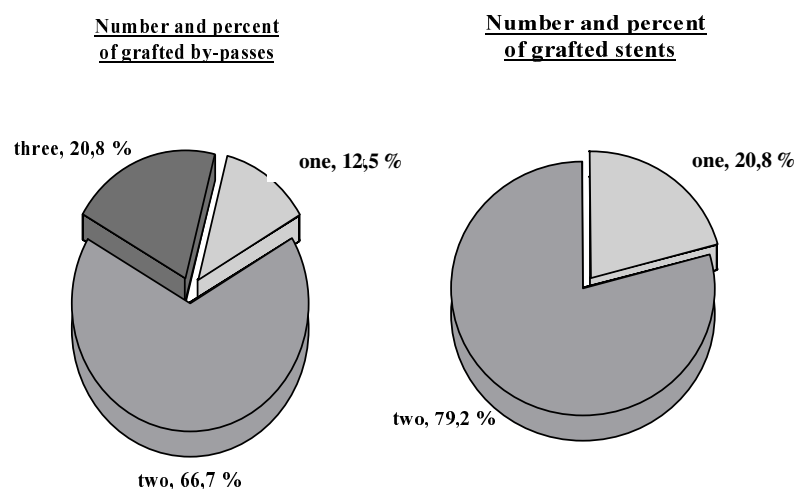
All patients were informed of the objective of the conducted study and of the form of the treatment they were to be subjected to. In all cases their consent was obtained.

The hospital rehabilitation program for CABG group lasted 9 days and included:

- 1<sup>st</sup> to 2<sup>nd</sup> day (intensive care unit): breathing exercises, active range of motion exercises for upper and lower extremities in supine and sitting positions, supine-to-stand transfer training;
- 3<sup>rd</sup> to 5<sup>th</sup> day (exercise room): breathing exercises, active range of motion exercises for upper and

**Fig. 1**

The number of grafted stents and by-passes in both investigated groups



lower extremities in sitting, isometric exercises, postural reeducation exercises;

- 6<sup>th</sup> to 9<sup>th</sup> day (exercise room): active range of motion exercises for upper and lower extremities in sitting and standing positions, gait training, stair climbing.

After completion of nine days of rehabilitation, 20 patients from the CABG group were immediately discharged from hospital, whereas four remained at hospital for a total of 12 days due to wound healing problems.

The hospital rehabilitation program for the CASI group lasted six days and included:

- 1<sup>st</sup> to 2<sup>nd</sup> day (exercise room): breathing exercises, active range of motion exercises for upper and lower extremities in supine and sitting positions, supine-to-stand transfer training;
- 3<sup>rd</sup> to 4<sup>th</sup> day (exercise room): active range of motion exercises for the upper and lower extremities in sitting and standing positions, ambulating;
- 5<sup>th</sup> to 6<sup>th</sup> day (exercise room): active range of motion exercises for the upper and lower extremities in sitting and standing positions, ambulating, gait training, stair climbing.

The above-captioned inpatient cardiac rehabilitation program was completed by 22 patients from the CASI group. Two quit the program on the fifth day, leaving hospital at their own request.

The outpatient rehabilitation program lasted 21 days and was similar for both groups of patients. All patients began that phase within 3 weeks of the day of their discharge from hospital. The phase II rehabilitation program included:

- exercises in various starting positions and with the use of rehab supplies and exercise equipment (exercise room; twice a day, 20 minutes each session)

- interval exercise training program on cycle ergometer, 4 minutes of work interval followed by 2 minutes of rest interval (3 times a week, 30–45 minutes each session)
  - swimming exercises (swimming pool; 3 times a week, 20–30 minutes each session, breast stroke)
  - gait training (gradually from 2 to 6 kilometres)
- All patients completed the phase II rehabilitation program.

HR response to physical exercise at the time of initial measurement was essential as far as setting the training load, which was adjusted between 60–70 % (in subjects aged over 60) (Belardinelli et al., 1995; Killavouri et al., 1995; Killavouri et al., 2000; Meyer et al., 1997; Sturm et al., 1999) and 70–80 % (in subjects aged under 60) of HR increase value obtained in that measurement (Braunwald, 1997; European Heart Failure Training Group, 1998; Fletcher et al., 1990; Hambrecht et al., 2000; Reinhart et al., 1998; Willenheimer et al., 1998).

The assessment of exercise tolerance was performed on the basis of results obtained during submaximal stress tests on a treadmill (according to Bruce's protocol). The stress tests were performed twice in each group, first prior to the CABG or CASI procedure (initial test) and then after completion of the entire rehabilitation program (final test). The following parameters were analysed: test time [min], covered distance [m], heart rate [beats per minute] and blood pressure [mmHg] responses to exercise, metabolic cost [METs], double product, reasons for stress test interruption (physiological: heart rate rise limit, fatigue; pathological: stenocardia, dyspnoea, ST segment depression, disturbances in rhythm). All results obtained on the treadmill stress test were gathered with the use of Optimus-Oxford computer software.

All stress tests were supervised by a qualified and experienced hospital employee and additionally by a medical doctor (cardiologist). They both supervised the stress test for all 48 patients.

Stress test performance sometimes results in undesirable responses, as observed in some patients. A surface which continues to move underfoot, variations in treadmill inclination and/or strange noises generated by the equipment, make some patients grip the treadmill railing tightly, hold their breath, lean forward or walk in an atactic way. To avoid the mentioned above problems, the test procedure was clearly explained to all patients. Patients were also allowed to perform a pre-test for 2–3 minutes. Persons supervising the main test did not use any form of verbal encouragement to stimulate patients to overcome higher loads, which otherwise could have resulted in an unreasonable extension of the stress test time. That, along with the opportunity of performing the pre-test, enabled us to assess objectively patients' functional capacity.

Both initial and final tests, as well as all training sessions, were performed at the Cardiac Rehabilitation Department and in the ergometric laboratory of Górnośląskie Centrum Medyczne (Upper Silesian Medical Centre) in Katowice-Ochojec, Poland. Training and measurement conditions were identical for all patients.

The results obtained were subjected to statistical analysis, which included the calculation of distribution of measured variables with the use of the W Shapiro-Wilk's test. In some cases, the data deviation from normal distribution appeared to be statistically relevant. For these variables non-parametrical tests were used then, such as the U Mann-Whitney's test (for description of relevance of differences between groups) and the Wilcoxon's test (for description of relevance of differences within particular groups). The t-Student's test was used as the parametric equivalent of the above mentioned tests for independent and dependent data, respectively. Prior to the t-Student's

test (independent data), homogeneity of variance for each analysed pair of variables was assessed with the use of the Levene's test. Lack of homogeneity was found only in one case, and here, in addition to the t-Student's test, the assessment of variation of both parameters was used (Cohran-Cox's test). For the purpose of qualitative analysis, the McNemar's test was used.

## RESULTS

Study groups were primarily analysed according to age parameters. No statistical relevancy was found here ( $p = 0.2755$ ), therefore it may be stated that this variable neither affected further statistical analysis, nor final conclusions.

In the CASI group the stress test time increased significantly after the procedure, from the mean value of 7.40 up to 9.51 minutes ( $p = 0.0006$ ), as did the covered distance, from the mean value of 312.5 up to 441.25 meters ( $p = 0.00015^*$ ). The average metabolic cost increased significantly as well, reaching the value of 12.49 METs versus 10.1 METs recorded at the time of the initial test ( $p = 0.0014^*$ ) (TABLE 1). The number of the tests terminated due to pathological criteria decreased, though no statistical relevancy was noted here ( $p = 0.1305$ ) (Fig. 2).

Similar changes were noted in the CABG group, here the time of the stress test increased significantly from the value of 5.51 to 8.40 min ( $p = 0.000006$ ), as did the covered distance from 231.83 to 361.71 meters ( $p = 0.00083^*$ ) and the work load from 7.84 to 10.6 METs ( $p = 0.00123^*$ ). The values of maximum HR and double product have increased considerably as well, from 123.42 to 136.88 beats/minute ( $p = 0.00071$ ), and from 20770.8 to 23267 ( $p = 0.0139$ ), respectively (TABLE 2). Also statistically relevant was the drop in the number of pathological reasons which were recognised as the criteria for the stress test termination ( $p = 0.00051$ ) (Fig. 2).

**TABLE 1**

Mean values and standard deviations of results; trust level of differences between initial and final tests in the CASI group

Variable	Initial test	Final test	P level
Time [min, sec]	7.40 ± 2.17	9.51 ± 2.17	0.0006
Distance [m]	312.5 ± 135.57	441.25 ± 138.23	0.00015*
HR [beat/min]	134.88 ± 14.65	138.33 ± 13.39	NS
SBP [mmHg]	176.84 ± 22.02	176.67 ± 23.16	NS
DBP [mmHg]	86.04 ± 10.42	86.88 ± 12.92	NS
Work load [MET]	10.1 ± 2.37	12.49 ± 2.37	0.0014*
DP	23752.5 ± 3959.8	24438.3 ± 3944.1	NS

HR – heart rate

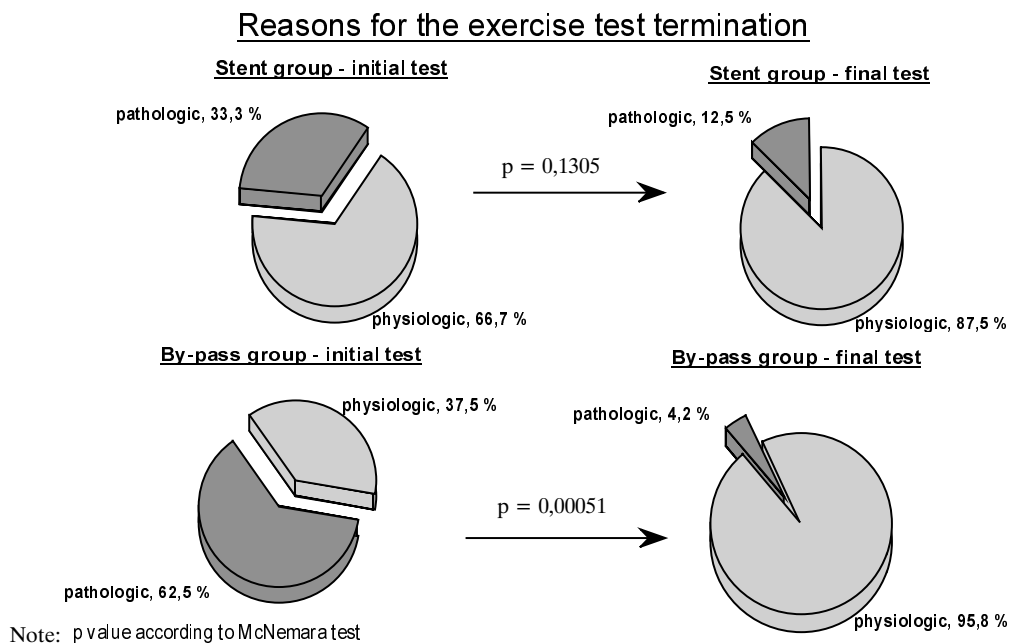
SBP – systolic blood pressure

DBP – diastolic blood pressure

DP – double product

**Fig. 2**

Proportional distribution of criteria for termination of the exercise test; trust level differences between initial and final tests in CASI and CABG groups

**TABLE 2**

Mean values and standard deviations of results; trust level of differences between initial and final tests in CABG group

Variable	Initial test	Final test	P level
Time [min, sec]	5.51 ± 2.17	8.40 ± 2.03	0.000006
Distance [m]	231.83 ± 156.40	361.71 ± 122.64	0.00083*
HR [beat/min]	123.42 ± 19.71	136.88 ± 12.58	0.00071
SBP [mmHg]	167.5 ± 20.48	169.58 ± 21.56	NS
DBP [mmHg]	86.04 ± 14.06	80.83 ± 10.49	NS
Work load [MET]	7.84 ± 2.34	10.6 ± 1.87	0.00123*
DP	20770.8 ± 7715.0	23267.0 ± 3950.2	0.0139

HR – heart rate

SBP – systolic blood pressure

DBP – diastolic blood pressure

DP – double product

The initial assessment of differences between the CABG and CASI group was performed in relation to the following parameters: stress test time (7.40 versus 5.51 min;  $p = 0.0058$ ), covered distance (312.5 versus 231.83 m;  $p = 0.0063^{**}$ ), maximum HR (134.88 versus 123.42 beats/minute;  $p = 0.0339$ ), work load (10.1 versus 7.84 METs;  $p = 0.001^{**}$ ) and double product (23752.5 versus 20770.8;  $p = 0.02$ ). Therefore it may be concluded that patients from the CABG group

demonstrated a considerably lower exercise tolerance (TABLE 3).

After the surgical procedure, the characteristics of results changed. All differences found between groups before, now appeared not to be statistically relevant, except the work load (12.49 versus 10.6 METs;  $p = 0.0036^{**}$ ) and the covered distance (441.25, versus 361.71 m;  $p = 0.04$ ). Therefore the results of patients from the CABG group were similar to those obtained by patients from the CASI group (TABLE 4).

**TABLE 3**

Mean values and standard deviations of results; trust level of differences between CASI and CABG groups in initial test

Variable	CASI	CABG	P level
Time [min, sec]	7.40 ± 2.17	5.51 ± 2.17	0.0058
Distance [m]	312.5 ± 135.57	231.83 ± 156.40	0.0063**
HR [beat/min]	134.88 ± 14.65	123.42 ± 19.71	0.0339
SBP [mmHg]	176.84 ± 22.02	167.5 ± 20.48	NS
DBP [mmHg]	86.04 ± 10.42	86.04 ± 14.06	NS
Work load [MET]	10.1 ± 2.37	7.84 ± 2.34	0.001**
DP	23752.5 ± 3959.8	20770.8 ± 7715.0	0.02

HR – heart rate

SBP – systolic blood pressure

DBP – diastolic blood pressure

DP – double product

**TABLE 4**

Mean values and standard deviations of results; trust level of differences between CASI and CABG groups in final test

Variable	CASI	CABG	P level
Time [min, sec]	9.51 ± 2.17	8.40 ± 2.03	NS
Distance [m]	441.25 ± 138.23	361.71 ± 122.64	0,04
HR [beat/min]	138.33 ± 13.39	136.88 ± 12.58	NS
SBP [mmHg]	176,67 ± 23.16	169,58 ± 21.56	NS
DBP [mmHg]	86.88 ± 12.92	80.83 ± 10.49	NS
Work load [MET]	12.49 ± 2.37	10.6 ± 1.87	0.0036**
DP	24438.3 ± 3944.1	23267.0 ± 3950.2	NS

HR – heart rate

SBP – systolic blood pressure

DBP – diastolic blood pressure

DP – double product

## DISCUSSION

It may be assumed that the results obtained during initial examination reflected the patients' clinical picture. Analysis of differences between groups showed, that patients referred to CASI procedure were able to tolerate much higher exercise loads, when compared with those who were to undergo the CABG procedure. Statistically relevant differences were found in almost all measured parameters, except systolic and diastolic blood pressure. It is apparent that the extent

of MI and a number of critically stenosed coronary arteries contributed to such results. In spite of continually improving results of percutaneous revascularization procedure, open heart surgery remains an irreplaceable method in treatment of ischaemic heart disease, especially in the presence of stenosis of 3 or more coronary arteries (CABRI Trial Participants, 1995; Caracciolo & Davis, 1995; Engblom & Hamalainen, 1992; Mark & Nelson, 1994; The Writing Group for the Bypass Angioplasty Revascularization Investigation /BARI/, 1997). As was already stated,

studied patients referred for treatment of CASI were shown to have stenosis of no more than 2 coronary arteries with a small area of ischaemia, therefore they did not need open heart surgery.

The main objective of either the coronary bypass or stenting procedure is the removal of obliteration located in coronary arteries, which is supposed to relieve pain symptoms, improve the quality of life (activities of daily living) and increase the level of physical activity. Such effects may be experienced by patients already within the first months following the procedure (Booth & Deupree, 1991; Caine & Harrison, 1991; Jenkins & Stanton, 1983; Klersy & Collarini, 1997; Sjoland & Caidahl, 1997). The improvement may be noted in changes of objective parameters such as extension of stress test time and toleration of higher loads [METs] (Sjoland & Caidahl, 1997; Engblom & Korpilahti, 1997; Ross et al., 1978; Ross & Monro, 1981; Stanton & Jenkins, 1984), which was found in the present study as well. The time period of 2–3 months after the procedure, that is immediately after the completion of phase II of cardiac rehabilitation is, according to many authors, the time period, in which the improvement of exercise tolerance and thus quality of life is the most considerable. After the lapse of 6–12 months after the procedure and even later, that improvement is to a lesser extent (Caine & Harrison, 1991; Klersy & Collarini, 1997; Sjoland & Caidahl, 1997; Trzcieniecka-Green & Steptoe, 1994). Therefore it seems to be highly advisable to implement permanent exercise programmes (of adequate intensity, under supervision of physical therapists) which would constitute prophylactic measures aiming at prevention of another MI.

The conducted analysis of level of exercise tolerance clearly indicates that utilisation of non-invasive methods of treatment, along with appropriate rehabilitation, brings the expected results in treatment of post MI patients. The programme of rehabilitation which was used in the present study justified its efficacy, bringing a considerable increase of exercise tolerance to both groups studied. Results of stress tests conducted after the completion of phase II rehabilitation show, that the most significant improvement of exercise capacity is noted in the CABG group. The analysis of both groups revealed relevant differences only in the two following parameters: the amount of load [METs] and the covered distance. These results prove the need of cardiac rehabilitation after cardiosurgical procedures, though some authors still question its role, claiming that the coronary artery surgical procedure itself results in improvement of a patient's exercise capacity (Dubach et al., 1995; Agren et al., 1989). Fortunately, there are only a few authors who support this kind of statement, and it is generally known that limitation of or even elimination of rehabilitation from the treatment course of patients after cardiosurgical procedures brings many undesirable side effects. Not only is the issue of rehabilitation so crucial, but also the length in time of its duration

during the inpatient phase. The present study has shown significant improvement of exercise capacity in both groups studied, though the most considerable increase was noted in patients who underwent the CABG procedure, despite the fact that this procedure is much more traumatic than the stenting one. It seems that it is the duration time of inpatient rehabilitation which affects the results. In the CASI group, rehabilitation lasted 6 days, but 2 patients quit rehabilitation on the fifth day, and that unfavourably affected the results of the study. In the CABG group rehabilitation was continued for 9 days after the surgery, and in case of 4 of the patients, even for 12 days.

Exercise capacity rated at the level of 5 METs in patients with ischemic heart disease predicts a poor prognosis. However after the (especially complicated and extensive) MI, these patients very often reach a level of 5–7 METs (Fletcher et al., 1990). These opinions were confirmed in our observations. Patients who underwent extensive MI managed to obtain a level of about 7.8 METs during the initial test. They were referred for the CABG procedure, and after completion of phase I and II of rehabilitation, their exercise capacity increased up to the level of 10.6 METs, which is a relatively good result. A similar level of relatively good exercise capacity (10.1 METs) was reached during the initial test by patients who were to undergo the CASI procedure. The level of 13 METs and over, despite some undesirable responses observed during the test, is considered to be a very good result and patients from the CASI group managed to reach an average level of 12.49 METs after completion of rehabilitation.

During the stress test, some of the CABG patients complained of pain in the thorax area or in the lower extremities. These are typical symptoms experienced by patients who have undergone a sternotomy and the procedure of saphenous vein graft removal. According to Jenkins and Stanton (1983), within the first 6 months since the surgical procedure, 35–39 % of patients complain of symptoms in the thorax area and in the lower extremities, 48 % report fatigue and general weakness and 18 % experience shortness of breath. Engblom et al. (1992), besides pain experienced in the sternum (33 %) and shoulder areas (22 %), also mentions episodes of dysrhythmia (31 %). Some of the above mentioned symptoms may be of psychological origin as well (Mayou & Bryant, 1987). Therefore the finding of such symptoms in study patients (with normal values of objective parameters such as HR and BP) were not treated as a pathological response to exercise.

In the cases of three CASI patients, the final results of the test appeared to be slightly worse than the ones recorded during the initial test, which resulted in a lower increase of exercise tolerance among patients from this group. There are many reports proving the high effectiveness of the CASI procedure (Fischman et al., 1994; Serruys et al., 1994), and so it was observed in our study too, though the problem of restenosis remains difficult to eliminate. In the case of

the above mentioned three patients, there was a quick restenosis (within 1.52 months after the procedure). It was due to proliferation of tunica intima cells of the coronary artery. This observation is in accordance with the results of the European Programme BENESTENT II (Legrand et al., 1997). Perhaps frequent restenosis results from technical mistakes made during stents implantation, and even in our centre (after completion of this study), there were cases of patients who, as early as one month after the procedure, were reporting symptoms typical for angina pectoris, which were later confirmed during the initial stage of the stress test. Some authors (Mintz et al., 1996) claim, however, that the main reason for such sudden restenosis is the proliferation of cells constituting the neointima and production of extracellular matrix. None of the patients from the CABG group obtained worse results at the time of the final test, when compared with the results of the initial test. However it does not seem reasonable to assess the effectiveness of any of the analysed treatment methods only on the basis of the data acquired. Our own observations show that individual cases of sudden restenosis were also found in patients who were post CABG procedure. In the presented study however, this kind of problem was found in post CASI procedure patients only.

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**ČASNÉ EFEKTY ÚSTAVNÍ (FÁZE I)  
A AMBULANTNÍ (FÁZE II) SRDEČNÍ  
REHABILITACE U PACIENTŮ PO INFARKTU  
A NÁSLEDNÉ LÉČBĚ METODOU  
TRANSPLANTACE BYPASSU KORONÁRNÍ  
TEPNY NEBO IMPLANTACE KORONÁRNÍHO  
STENTU**

(Souhrn anglického textu)

Společně s rostoucím počtem pacientů po transplantaci koronárního bypassu (CABG) nebo implantaci stentu (výztuž) koronární artérie (CASI), se objevil problém stanovení odpovídajícího rehabilitačního programu pro tyto dvě skupiny pacientů. Záměrem této studie bylo zhodnotit úroveň snesitelné zátěže u pacientů, kteří byli po prodělaném infarktu myokardu léčeni chirurgicky oběma metodami a kteří později byli podrobeni navrhnutému rehabilitačnímu programu.

Byly vyšetřovány dvě skupiny mužských pacientů. První, složená z 24 pacientů, kterým byl proveden koronární bypass /CABG/; druhá – 24 pacientů s implantací koronárního stentu /CASI/. Zhodnocení snesitelné zátěže bylo provedeno na základě zátěžového testu na šlapadle (podle Bruceova protokolu). Test byl proveden nejprve před chirurgickým zákrokem a potom po skončení předepsané dvoufázové rehabilitace.

Po skončení léčby se u skupiny pacientů se stentem čas zátěžového testu a ujetá vzdálenost výrazně zvýšily. Rovněž se výrazně zvýšil průměrný metabolický výdej. U skupiny s bypassem se čas zátěžového testu výrazně zvýšil, rovněž ujetá vzdálenost, maximální odpor, dvojnásobný výsledek a pracovní zátěž. Statisticky významný byl rovněž pokles v počtu patologických důvodů pro ukončení testu.

Program rehabilitace použitý v předložené studii odůvodňuje svou efektivnost, přináší značný vzrůst snesitelné zátěže u obou zkoumaných skupin.

*Klíčová slova:* CABG (transplantace bypassu koronární tepny), CASI (implantace výztuhy – stentu koronární tepny), tělesná výkonnost, šlapadlový zátěžový test.

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## INSTRUCTIONS FOR MANUSCRIPT FOR THE ACTA UPO GYMNICA

The magazine Acta Universitatis Palackianae Olomucensis Gymnica is an independent professional magazine. The content of the magazine is focused on presentation of research notifications and theoretical studies connected with the problems of kinanthropology. The Editorial Board is looking forward to all manuscripts written on the above subject.

### General instructions

The text of the contribution is in English. The contribution is not to exceed a maximum limit of 15 pages (including tables, pictures, summaries and appendices). A summary will be in the Czech language, and by rule 1 page at the most.

The text is to be presented in MS Word editor on a diskette and also as a printout.

All contributions are reviewed anonymously.

### Interface of the contribution

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All contributions to Acta UPO Gymnica must have been corrected by an English expert before being submitted to us. Please enclose an official confirmation of this correction. If possible we would appreciate the text in the original language.

We look forward to our further cooperation!

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