ACTA UNIVERSITATIS PALACKIANAE OLOMUCENSIS

# GYMNICA

**Vol. 30**
**No. 1**

PALACKÝ UNIVERSITY OLOMOUC
OLOMOUC 2000

ACTA
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OLOMUCENSIS

FACULTAS CULTURAE PHYSICAE

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**ISBN 80-244-0115-0**
**ISSN 1212-1185**

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## OBSAH

# THE CORPOREAL SCHEMA AND HEALTH PROBLEMS

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Submitted in April, 2000

The article problematizes the concept of health from the philosophical viewpoint. It analyses "health" in connection with the Aristotelean and Heideggerean concept of "physis" as motion. The sequence of reflections leads to the complex of problems of the corporeal schema (the philosophy of Merleau-Ponty) as an example for an extended concept of physical motion in the sense of physis. Health within the overall meaning is related to the ideal of Areté.

*Keywords: physis, corporeal schema, Areté ideal, health, entirety, motion, background and figure.*

To be a healthy person means to be attuned to the entirety of the world, i.e. to be aretéd out. It is not only a state of psychic, physical and social comfort because what is essential for man is also what transcends these three spheres which are common for life in the materialistic concept. In ancient Greece, the gymnastics instructor was regarded higher than the physician, because the latter came into action only where the former had failed. It was the gymnastics instructor who aretéd not only the human physical but also psychical makeup with the needs of the Polis, and all this took place with regard to an overlap of these three spheres. This long and complex process of attuning the instructor's charges is a constant process of harmonization.

That is why man's health can be likened to a bow from which arrows are shot towards the bull's-eye. If an arrow is to be released towards the target, it must be fitted between the bow and the string only within certain intensity. The two must come apart, their unity must be impaired, their antithetical character is enhanced only to a certain moment, and only then is it possible to shoot with accuracy. Thus, health contains within itself antithesis, which stabilizes at a certain point. This antithesis is characteristic also for the Greek PHYSIS (growth, budding). Physis is the basis of motivity of living creatures as well as of flowers. This motivity always contains the antitheses of life and death, origin and extinction, Dionysus and Hades, yin and yang etc.

Health cannot be a state because it is the motivity of physis. Everything that arises and becomes apparent thus conceals itself at the same time. The bow and the string act simultaneously, as does origin through extinction, and vice versa.

Since health is motivity within the meaning of PHYSIS, it is good to remind ourselves that birth and death need each other as the bow and the string; they are always together, and that is why in ancient times this relationship was celebrated by the Eleusinian mysteries. The goddess Demeter was associated with the grain the death of which gave birth to ears with new grains, she symbolized the Heraclitean analogy of the bow, she provided assessments, measured relations. Health is not any state arising from additions of components, parts, and pieces. Health is a whole constituting itself in continual motivity. A state is death, end. Health is where motivity is, and that is why the gymnastics instructor was above the physician. The latter treats a state – illness, and also the term "nemoc" (illness, incapability) is derived from inability (nemoci – to be incapable) to move. To restore health thus means to restore motivity of the bow, by the antithesis, which constitutes the ability to move. The word "motion" is weak, inappropriate, empty.

The antithetical action of the bow's arch and string with the aim to make the arrow hit the bull's eye symbolizes the two aspects of motivity, PHYSIS. Heidegger's terms for one is Anwesung, and for the other Abwesung. "Es west" means in German the same as the Czech "zapadá do místa" (falls onto, sinks into; der Westen – západ – the west). The prefix "an-" means "on, onto", the prefix "ab-" means "from" – Anwesung is thus everything that fits into some place, and is therefore objective, whereas Abwesung is what exists but has no place, does not fall in, i.e. is concealed. PHYSIS – motivity, growth, budding, is seen as the most difficult concept of ancient philosophy – but why? Because it contains both Anwesung and Abwesung. This means that every growth of the body is simultaneously the commencement of the body's death, every performance of the spirit or body is supplemented complementarily by decrease of lifetime, every seed produces a plant only through its own extinction, every movement is the unveiling of something that enters the illuminance of comprehension, but also the concealing of something that makes possible phenomenalization (i.e. entry to

a certain place, to Anwesung), and what in itself does not have a place, i.e. is a background, horizon, what we call Abwesung.

Existences have entered light, and have thus gained a place ("Ort" in German is the tip of the javelin, hence der Ort = place). What is it that this reflection has in common with health? The reason is that alongwith the process of ageing, death also belongs quite intrinsically to the PHYSIS of the human body, and that they must be components of health. Health cannot be only a state of wellbeing of our psyche, our body and our societal existence with others. Health also means capability of ageing without hysteria, to know that it is full-value existence, to know that it is not only performance that is part of man's full-value life which also includes composed wisdom and composed strength. From the viewpoint of physical education, health is thus a much more extensive term because it views health as Entirety, not only psychical makeup, corporeality, society but also transcendence to the Entirety of the world, and therein lies incontestable superiority. Motivity – PHYSIS is the essence of health, not only mending of various parts of our body when it is already too late, when PHYSIS, i.e. motivity, has already been impaired. Motivity is not only movement along a track, but also growth, also ageing; it is man's overall activity through which human life constitutes itself, it is always a whole, Areté, not functionality as it is mostly perceived today by the general public. Here, gymnastics is the only guarantor of health in the sense of Areté, i.e. vital fitness, excellence that is not reduced only to individual performance but is oriented on man's whole life.

Life which is not perceived metaphorically as movement along the road on which there is also a horizon (Telos – objective) towards which we proceed. We plan our movement along the road on the basis of entelechia (inner purpose), from arché (our point of origin) through selection of possibilities (dynamis) which we then realize (energeiá).

All this is also KINESIS – motion, which is the domain of us physical educationists – this must not be forgotten.

The physical educationist is taking part in life as in entirety, and therein lies his role in the maintenance of health. The physician provides treatment when movement along the road is prevented by incapacity. Even etymology of words contains references to the subject. But let us now return to the term motivity, to PHYSIS, KINESIS.

To return to this motivity, i.e. health, means not only to restore the functioning of their various organs, e.g. to remove a diseased gallbladder, but also to restore their vitality, their vigour needed for surmounting the obstacles of everyday life. Ancient Greeks would use the term iatreusis for the removal of gallbladder, and the term ugiansis (hence hygiene) for the latter.

The physical educationist attunes man to the Entirety of the world, i.e. he aretés him, harmonizes him, and thus provides prevention against diseases, upkeeps his PHYSIS.

The modern times have completely suppressed this reference to Entirety. Why? The answer is simple: because "Entirety of the world" became, in Cartesian thinking, a jigsaw puzzle, a system, structure, addition of formants, elements etc. The entirety of the world can be expressed as a set of functions in a mathematical formula, etc. The world as a whole has been transformed into something that we can control, that is here for us to use, and hédoné (pleasure, wellbeing, delight, the sense of power over others, will to power etc.) has become the highest value. Areté as Entirety, as existence, has become an object even though Entirety of the world is not objective, factual, finished. Entirety has become a large part, Cosmos-order has transformed itself into scholastic systems, has lost respectability. Thauma-miracle is misunderstanding today.

Horizons of thinking have shrunk into systems, and also health has therefore become a function leading to an attitude of comfortness. Values have been made relative. Reduction of subjectivity to "cogito", reduction of perception to apophantics accompanies present-day humanities. Life cannot be reduced to a set of physiological functions, which can be measured in hard data, modelled and constructed. It is within these perspectives that present-day science on health and life is developing.

To understand motivity means to comprehend total intention, and this means relationship to Entirety, background, and horizon. This total intention relating to the human body is termed corporeal schema by Merleau-Ponty. It is a concept, which is also in use in psychology where it represents a chain of associations. Corporeal schema relates to human health in a very substantial manner. It combines tactility, visuality, auditivity, proprioception and interoception into one whole. Merleau-Ponty adds to this: "No psychical individual is conceivable as a function of variables, but as a creative force which is always connected to Entirety, to sense". Cf.: Merleau-Ponty, M.: Phänomenologie der Wahrnehmung. Berlin 1966, p. 28.

Every sensation contains both real components of perception (i.e. those which are in our flux of conscious contents directly perceivable), as well as transcendental intentions (i.e. components drawn from our memory). For example, the sensation of red contains also the concept of colour in general, and it is not really perceived, it is an addition from our memory, from our experience, which is created in our consciousness not only freely but also subconsciously. What is actually given refers to what is non-actual. Every sensation is a synopsis, it is not a simple, blunt reflection. Taking part in a significant way in this complex network of intentional implications is our corporeal memory, which is cared for mainly, among others, by the physical educationist. In this connection, it is necessary to take a closer look at the phenomenon of corporeal schema.

That is also why Merleau-Ponty does not view perception as inception of science, as is usual in empirism. Intentions govern our perceptions, interlink what is perceived with the yield of our past experience which always has a global character, affecting both mind and body. Many animals have much better sensory prerequisites and yet do not pursue science.

One-sided empirism is untenable both in kinanthropology and in medical science, despite the fact that contemporary medicine is, above all, an amazing technology connected to the information explosion. Diagnoses are today provided by computers, for the most part on the basis of analyses of bodily fluids or directly by means of inspections inside the body, e.g. computer tomography etc.

**THE ROLE OF GLOBALITY IN THE CONCEPTS OF BODY, HEALTH AND MOTION**

Our life is governed by the pre-objective intention "zur Welt sein" (to be world-attuned) which is part of the corporeal schema that is the yield of proprioceptive experience, which is created during our life. Corporeal schema as a virtual idea of the body in its entirety connects reason with our motoric system. This entirety intention is not a sum of reflexes; it is the yield of the entire physical experience, we cannot perceive it objectively, and therefore we do not reach corporeal schema by Cartesian procedures. It is a phenomenon, nothing measurable. Corporeal schema is so near that it cannot be verified sensorily. Just as a fish realizes that water is the environment without which life is impossible only when it finds itself on dry land, also we recognize corporeal schema only when it is impaired. In the case of a phantom member, the corporeal idea of the amputated part of the body is permanently present in the corporeal schema, but in the case of anosognosis, the diseased part of the body is present in reality but is missing in the idea of one's body. The anosognostic leaves his, for example, diseased arm outside the play in order not to have to experience its unusability. Both phenomena (phantom member and anosognosis) are not at the level of thetic consciousness, i.e. objective, perceived consciousness, but lies deeper in the layer of corporeal schema.

Corporeal schema is sometimes called habitual, i.e. overall body in contrast to the actual body, i.e. that body which we are experiencing at the moment. Habitual body is a means of communication with the world, and it is therefore possible to say that the world is the sum of latent horizons, which have their basis in physical experience. What does this mean to the physical educationist? Only that in the present time, the importance of physical education is still underrated. The schema of the body is formed by the entire physical experience and functions as background from which figures of complex motion are reflected, i.e. motion which has both intellectual and motoric components, and therefore impairment of the schema manifests itself above all in defects of speech, which is the most typical interconnection of reason and motoric apparatus – defects such as aphasia, agnosia, apraxia, dealt with in greater detail in Phaenomenologie der Wahrnehmung, Berlin 1966, by Maurice Merleau-Ponty who formed his hypotheses on the basis of his discussions with the neurophysiologists Gelb and Goldstein, psychologists Kofka, Piaget, Head, Wertheimer and others.

On the basis of his collaboration with Gelb and Goldstein, Merleau-Ponty lists in his Phenomenology of Perception the so-called tailor's disease as an example of impairment of the corporeal schema. Cf. Merleau-Ponty, M., 1966, pp. 134–135.

The patient is incapable of ascertaining in which part of the body, mechanical irritation has occurred; for example, in order to find his head, he must move his whole body and through such movement is capable of becoming aware, where his head is. This inability to localize tactility is caused, according to Merleau-Ponty, by inability to differentiate between intellectual and motoric significance; ibid., p. 136. It is inability to distinguish the figure of touch from the background, i.e. from the corporeal schema. In normal man, every motion has its background from which it takes off, from which motion emerges and thus becomes localized. Concrete motion is centripetal, abstract-virtual motion is centrifugal. Both kinds belong to the corporeal schema. When the idea of motion, i.e. abstract motion – virtual motion, is missing, impairment of the corporeal schema occurs. František Véle, MD, of the Chair of Rehabilitation, is convinced that it is posible to enhance rehabilitation possibilities by ideo-motoric training, which is nothing else but imagining certain movements; he believes that it is necessary to undergo virtual movement training. Corporeal schema is thus trained. It is known also from empirical research that in such cases, the patient's condition is incomparably better.

Thus corporeal schema, which can neither be measured nor verified sensorily, is one of the immensely important entities in our body.

Man often executes complex movements of which parts are performed by the hands, others by the legs, and for which appropriate positions of the head and of the centre of gravity of the body are necessary, etc., everything being done simultaneously, at the same moments in time. It is possible to make such movements only when the abstract-virtual idea of the entire movement is disengaged from the background, when the overall figure emerges from the background of the corporeal schema; when this is not possible, no movement is performed.

This brings to mind "Passgang" in training of cross-country skiing, and inability to perceive a complex motion as a simple action in gymnastics, volleyball and other sports. When attention is centred on individual details, the overall idea of the intended movement disintegrates, and failure results. The abstract projection of motion, virtuality, must emerge from the overall corporeal idea as a figure from the background

of the corporeal schema. That is why pure tactility is a pathological phenomenon. Motional experience is in direct connection with our perception. A chained dog has worse perception than a dog allowed to run free. Motion – proprioception, visuality, auditivity, tactility – all this is interconnected more than we realize today because altogether they form a whole. Senses are intentionally interconnected with proprioception, and the whole with intellect. Therefore we can speak of unity of intelligence, sensibility and motorics, underpinned by the corporeal schema.

Motion is much more important than we believe at present, not only for health but also for potency of intellectual type.

Persons suffering from alexia are incapable of distinguishing letters; it can be repeated that they lost the ability to separate the figure from the background of the corporeal schema. It is not a matter of engram destruction.

All knowledge originates from horizons, which constitute the background for the possibility of emergence of the figure, and also corporeal schema is such background. Only cognition of horizons makes it possible to comprehend matters; otherwise it is mere knowledge, factography and memory equilibristics. Also corporeal schema is one of the most important horizons in our life.

Sensation itself points to the unifying role of the corporeal schema. We have always been taught that sensation is the simplest reflection of objective reality in subjective consciousness. But it is not as simple as that. The person experiencing sensation and what is being sensed are not two separate or confronting entities, sensation is not an invasion into a person, as it is seen in naive realism. Every sensation is a reconstitution and is based on the sediment of previous constitutions, i.e. on experiences contained in the corporeal schema. Merleau-Ponty would say: "Sensation always pertains to a certain field", cf.: Phänomenologie der Wahrnehmung, Berlin 1966, p. 254. This field is the background formed by the corporeal schema. It is a pre-logical unity of experience, which constitutes the possibility, and validity of synergy in our body. The body is not only a sum of organs but also of synergy. The written word is not only a shape but also a dynamic idea of motion reflected from the background of the corporeal schema. Depth cannot be projected on the retina, and yet we know of it; it is here that sensation as reconstitution is especially demonstrable. Only cooperation of the corporeal schema with what is seen at the moment is capable of lending depth to perception, which is not possible otherwise. The fact that perception of the world around us is underpinned by reconstitution of physical experience in us is also proved by hallucinations of psychiatric patients whose corporeal schema reconstitutes so-called reality (occasionally) in an entirely different manner than that of healthy persons.

Intention is virtual motion, and we can visualize corporeal schema as a network of virtual motions, intentions, which are interconnected vertically and horizontally within the network, but in a special way, not spatially; intentions refer to one another so that they preserve themselves by intentional connection, i.e. noetic-noematic connection. The given noema contains within itself noeses to further noemata, the subject contains in itself its own noesis (i.e. path of its origin and validity) with which the given noema-subject has come into existence, and this noesis is perceivable again as a noema referring further and further. Retentions, i.e. experience concealed in the past-memory, as well as in the subconscious, protend, protract themselves into the future, thus creating protentions, which are those structures through which sensation is constituted; here lies the essence of the aforesaid reconstitution. Each of retention produces further retention, and the process continues, thus forming the intentional network referred to above. Intentionality as the basic property of the flow of cogitation is the key to the comprehension of not only our mental and intellectual activities but also of our body in the form of the corporeal schema. It is therefore possible to comprehend intention as virtual motion, as protention, as pre-expectation through the intermediary of which we are approaching something, tending towards something. The corporeal schema is a network of these intentions, virtual motions without which it is impossible to live in the world, because things are correlates of our body, our physicality.

It is not possible to undervalue physical education and care because we would then be depriving our population of primary relationships to the world, offering possibilities to understand it. Without these intentions, virtual motions, we cannot perceive space and time and things with their relationships in space and time. Unity of these intentions then make possible synergy of our body, because a painter sees "through eyes scattered all over his body", as Cézanne said. That is why it is possible "to hear colours and see sounds". That is why we can be immensely happy in nature, why we can perceive not only beauty but everything that has the status of onticality in our life.

"Virtual motion thinks", Merleau-Ponty asserts; ibid, p. 441. And therefore the body cannot be understood as an object among objects. The original intentionality of the body and physicality is still not fully exploited, nor can it be, because the body and physicality have been dealt with scientifically only by means of Cartesian methodology. Also Nietzsche gives preference to this body, with "physical intelligence", in his well-known conception of volitional body the instinctiveness of which is the basis of will to power and full development of naturalness.

Neuroses are intimately connected with the consciousness of time, as we know from numerous Jungian analyses. The scheme of space and time is

directly proportionately dependent on the corporeal schema which is a network of virtual motions originating on the basis of physical experience; it is for this reason that physical education and physical care have such an enormous significance, just as sport has.

Every painting that is a work of art provides more than only what we do really experience while viewing it – intentions, which are not communicable otherwise. For this reason, a work of art differs from a mere photograph. When we are taking care of our body, also these intentions, constituting the primordial layer of our physicality and making it possible for us to understand ourselves and the world. Universality and the world are rooted in the innermost, in the individual, in the subject. The entire thetic, i.e. objective consciousness is made possible in a substantial manner by intentionality, which lies in its foundation, and is nothing else than intentionality of the corporeal schema.

No consciousness, not even the most free, is capable of severing ties with this intentionality, and that is why care for physicality must not be ignored. And the present time is very much inclined towards this. For this reason, it is necessary to discourse on these connections, not only in our scientific community but also, and above all, on the public forum.

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**TĚLESNÉ SCHÉMA A PROBLEMATIKA ZDRAVÍ**
(Souhrn anglického textu)

Článek problematizuje pojem zdraví z hlediska filosofického. Analyzuje „zdraví“ v souvislosti s aristotelským a heideggerovským pojetím „fysis“ jako pohybu. Sled úvah vyúsťuje do problematiky tělesného schématu (filosofie Merleau-Pontyho) jako příkladu pro rozšířené pojetí tělesného pohybu ve smyslu fysis. Zdraví ve smyslu celkovostním se pojí s ideálem Areté.

*Klíčová slova: fysis, tělesné schéma, ideál Areté, zdraví, celek, pohyb, pozadí a figura.*

# ONTOLOGICAL DIMENSION OF EXTREME STATES OF CONSCIOUSNESS AND THE PHYSICAL

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Submitted in March, 2000

The analysis of extreme states of consciousness (perinatal experience and transpersonal experience) is outside the sphere of normal science. Experience goes beyond the empirically evidenced frames of consciousness and become transcendental towards rational manifestations. The author offers hypothesis of possible worlds with emphasis on the authenticity of the experience in the role of the factor enabling an entry into the worlds like an acceptable ontological concept.

*Keywords: possible worlds, experience, extreme states of consciousness.*

The problems of the physical, which is the central term in a philosophical approach to physical culture, include extreme states of consciousness. The hypotheses trying to deal with these phenomena go beyond scientific paradigms and therefore do not get much attention on part of the foremost specialists, from kinanthropology not excepting. These issues of science and philosophy and the ontological grasp of the physical in man, are so urgent that they require thorough rethinking of their reality and of the way of their existence. Let us discuss these issues by means of theory of possible worlds and an analysis of experience.

Experiencing extreme states of consciousness (expanded, altered, experience of other worlds and of multiple reality, etc.) was registered in various cultures in the form of mysteries, initiation ceremonies, shamanistic practices, etc. A similar experience, however, can be induced artificially by means of psychedelic substances, breathing exercises, rhythmic drumming combined with ecstatic dancing, etc.

This area has been systematically studied for several decades by Stanislav Grof. After the ban on drugs in psychiatric research, he concentrated on breathing exercises and developed a technique called holotopic breathing (a combination of guided quickened breathing, music, body motions, and mandaka drawing), the so-called hyperventilation. This technique, as in other related cases, has relations with psychology and psychiatry, and by going beyond the scientific paradigms, it raises new objections to their traditional philosophical treatment of experience. Unanswered remains the relation between personal experience and its conceptual analysis, that is the relation between arguments and the evidence of experience of extreme states of consciousness and chance of their general acceptance.

For the sake of completeness, let us mention the close link between the detailed examination of this experience and the movement which makes use of psychedelic drugs (nonspecific substances enhancing unconsciousness as well as the cultural context of this experience) for self-analysis, transformation of consciousness, and states of exstasy. Psychedelic experience was popularized by the beat generation (Kerouac, Ginsberg, Ferlinghetti and others), linking it with life style and a critical social attitude. In addition to drugs, a very popular medium for acquiring extrarational knowledge was sex and jazz. To "enter it" meant experiencing the substances of being at one go, amplifying one's life experience through states of ecstasy. The use of nonspecific psychedelic substances depends on the individual traits of the personality as well as on a particular cultural pattern. The need was felt for *"some cultural frame for the altered states of consciousness. And since they were not available in the Euro-American cultural sphere, many people turned to other cultural traditions"* (Veselský 1997, 69). Thus the psychedelic experience was perceived through eastern types of spirituality, not through scientific and traditional philosophical systems (which never accepted this kind of esperience). Veselský distinguishes three groups which deal with psychedelic experience: the scientists using it as a form of psychotherapy; the lay public – a psychedelic movement linking this experince with the life style (drugs as physical recreation and mental relaxation – a phenomennon absolutely unthinkable in shamanistic and other traditional cultures); the intelligence service and the Army, considering drugs as a means of waging war. These extreme states of consciousness are closely associated with psychedelic substances but can be produced by other techniques as well, or can be even achieved spontaneously.

The analysis of extreme states of consciousness brings to the traditional model of man's psyche several other layers *"which exceed postnatal biographical data.*

*It is* the perinatal level*, characterized by an emphasis on the experience of birth and death, and the* transpersonal level, *which in principle can mediate the connection of the experience with any aspect of the world of phenomena and with various mythical and archetypal areas"* (Grof, 1993, 8–9). The mere listing of these areas shows the need for a completely different approach than is accepted in western science within the narrow boundaries of Descartes and Newton: idetification in experience with other persons, animals, plants, planetary consciousness, and the whole physical universe; embryonic experience, from the life of one's ancestors and past incarnations; experience of spiritism, meeting inhabitants of other worlds, mythology and fairy-tales, deities and archtypes; the Creator's experience, the cosmic consciousness, insights into the creative process in the cosmos. These extensions of consciousness beyond the boundaries of space, time and conventional reality are hard to explain, particularly when we accept the credibility of the testimony is of the participant. Grof classifies this experience in four main categories: abstract and aesthetic experience, psychodynamic experience, perinatal experience and transpersonal experience (Grof, 1991, 17). Classic psychology and psychiatry, however, regard this experience as an illusory state. These disciplines are based on an analysis of conscious states and dreams, and anything else is seen as something pathological and attempts are made to suppress it. Like Grof, we must wonder at this rejection by some scientists, who believe that the whole problem can be *"reduced to anatomy, physiology and biochemistry of the brain"* and who reduce their approach to an attitude in which *"spirituality is not an authentic and legitimate dimension of existence, but a manifestation of abnormal brain activity"* (8 otázek, 1995, 11). Those who take seriously to transpersonal psychology because what people say about them is found to be very impressive, are evaluated by traditional methods as irreal beings, originating from an assembly of notions and images. *"These notions are extremely vivid so that they can impress us as a perception, and then they become hallucinations or pseudohallucinations"* (Vondráček & Holub, 1993, 87). (A similar opinion – corresponding to the conventions of the modern general perception – was, however, far from obvious, in the recent past: e.g. the ontological reality of ghosts and spectres was accepted as obviously true as late as two hundred years ago, when in 1745 Becher wrote *"A Legal inaugural treatise on the spectres' rights".)* The recognition of the validity of improbable experience is, however, at least as much justified as the demands of quantum mechanics and theoretical physics that use mathematical *"formulations of events for which no natural explanation can be found"* (Havel, 1994, 570). The listing of possible polemical approaches may be closed by quoting the doubts of Jung (relating to different kinds of religious experience): *"Where is the criterion which would allow us say such a life is not legitimate, such an experience is not valid, and such a trust is a mere illusion"* (Rollo, 1993, 64). Rollo later adds (in connection with the mechanism of the origin of the values): *"The last and decisive part is the sum total of individual experiences because it holds true that nobody lives quite the same life"* (Rollo, 1993, 101).

The feeling of consciousness expanding beyond the boundaries of one's ego, the transgression of the limitations in time and space, and the crossing of boundaries of physical-sensual perception*,* are the principal features of extreme states of consciousness (whereas in the common consciousness we experience ourselves as a being limited by our physical body). The most important factor for our investigation, however, is the fact that these are not recollections or ideas of phantasy and cannot be simply rejected as a product of imagination (also because of the wealth of information from various fields that are contained in the experience). *"In a sense the full re-experiencing of events from our childhood and birth (as against the full remembrances) may be conceived as a real crossing of boundaries of time and space. In this case the person experiencing scenes form various periods of childhood and later life, or the struggle in the birth channel does not reconstruct these events from the memory record in the nervous system, but connects them directly with the time and space coordinates of the original event"* (Grof, 1993, 44–45). Let us emphasize once more, that we are not speaking of memories of a particular event but of re-experiencing an event, with all that belongs to it. This is also includes that fundamental feature of experience, the capacity for distinguishing the memory of an event from dreams and fantastic notions (equally as in the current consciousness one can identify a memory of an event from the previous day and it would be difficult to persuade someone that his memory is something he has thought up). How can we perceive these extreme experiences from the aspect of their ontological relevance? We believe that the hypothesis of possible worlds with its emphasis on the authenticity of the experience in the role of the factor enabling an entry into the worlds can even be an acceptable ontological concept here.

The possible worlds have quite different links to the patterns of time, space, polarity or causality. Transpersonal experience *"may bring a profound understanding of the processes of experience, which clearly go beyond the intellectual knowledge of the experiencing of these special areas and beyond the person's education"* (Grof, 1993, 96–87). Grof says that educated people described profound insights into astronomical and astrophysical problems which may be expressed by mathematical equations but cannot be understood fully by intuition (Einstein's concept of the infinite, the self-contained universe, the non-Euclidean geometry of Lobachevsky and Riemann, the time-space of Minkovsky, the collapse of time, space and natural laws in the black hole, and other difficult concepts from modern physics). The extreme states of consciousness make accessible experiencing various nonlinear relationss that cannot be explained by

a common transmission of energy and information. Certain parallels may be found in Jung's term of synchronicity and Shledrake's morphogenetic field.

Even if we decided to accept experience from the extreme states of consciousness, the technique for obtaining this experience might still be unacceptable to us. Inspiration by shamanistic practices, especially by psychotronic substances, but also by hyperventillation – deep breathing in a slightly raised rhythm with music accompaniment – the methods used to make experience emerge from the depth of unconsciousness to the surface, are for Štampach (1993, 126) the most questionable from the whole transpersonal psychology. A mild misunderstanding arose from the evaluation of anthroposophy, which regards these methods as external means and demands, in order to achieve the same results, the use of an inner effort while preserving wakeful consciousness as a controlling factor (Váňa, 1993, 9). Neubauer emphasizes, however, that this experience *"in fact was not produced by the respective techniques, but realized, due to the removal of external and internal disurbing effects, which normally escape our attention"* (Neubauer, 1993, 40).

The acceptance or non-acceptance of the extreme states of consciousness as an important experience, requiring thourough investigation, depends on many aspects. One of them is the issue, *"whether the mind is a quality originating from the interaction of the organism and its environment, or whether the mind reflects some fundamental organization of the universe (including the brain of the organism)"* (Pribram, 1992, 18). To this problem, however, there are more than two answers – one being a hologram model by Pribram, when the information on the object is spread over a surface so that each part in some way describes the whole (each organism in a particular way represents the universum and each part of the universum represents in a particular way the organism). In the holographic picture, time and space are squeezed in frequency, so that causality disappears and complementarity, synchronicity, symmetry and duality become the explaining principles. This vision of the world as a whole (corresponding better to the natural world) and recognizing physical and mental factors as the two aspects of one whole reality, when each of them in itself reflects and includes the other, was designed by Bohm and in this country popularized by Fiala and Neubauer. The holomovement is a universal movement of rolling up the whole into each area (an implicate order) and simultaneously unrolling of each area back into the whole (an explicate order). An example of the rolling and unrolling can be provided by the information brought by radio waves in an implicate order and by means of the receiver explicated to a visual form. This idea assumes the fact that mind and matter should pervade each other (and so something analogical to the mind should exist in the inanimate matter – mental and material as two aspects of one reality). It also assumes the interlinking of each human being with totality, including society and the whole nature. The holomovement is not limited in any specific way, it cannot be defined and measured, all its forms are interconnected and inseparable, even though it is possible to abstract from its partial aspects (light, electromagnetic waves, sound, etc.).

The anthropological basis and especially the attitude to the problems of consciousness can be a major factor for positive attitude or for negative rejection of this experience. One could even regard this attitude to the psyche and its structure as the fundamental condition for perception of transpersonal experience as either real or fantastic.

Since the era of psychoanalysis, the division of the psyche into the consciousness and unconsciousness has been accepted (whereas the distinction between subconsciousness and hyperconsciousness within the unconsciousness is not accepted generally). Gradually, the model of the psyche (and thus of the consciousness, too) is being abandoned as a substance, as an easily distinguishable state of yes or no, and the idea of the processual – experienced stream, functional dependencies, the impossibility of separating consciousness from conscious acts, etc. is being adopted. A certain character of the consciousness, the rhythm of activity, the concentration of attention or, reversely, the suppression, from sleep to loss of consciousness, can be also studied by measuring the bioelectrical activity of the central nervous system. This scientific method helps to determine the types of rhythm (alpha, beta, gama, théta and delta), from which much may be deduced the activity of the consciousness but not about its ontological status. (Mental processes cannot be reduced to the biochemical activity of neurons.) For the theme of extreme states of conciousness and the hypothesis of possible worlds one fact is invaluable, namely that from the wide spectrum of electromagnetic waves man can immediately perceive only a tiny section (light), although the others can be registered with instruments. Therefore there is no reason not to believe that there can be other qualities of being which are deduced by analogy only. *"Our sensors were developed for an adequate functioning of our life and not for obtaining complete knowledge of the world"* (Pstružina, 1994, 36). One of our foremost specialists in the problems of consciousness and brain, Koukolík, sums it up by saying that the relation between consciousness and brain (that is, mind and matter) was formulated in the 17th century in four fundamental forms: the materialistic theory (consciousness as a new system developing on physical foundations), the dualistic theory (two different forms of being affect each other), the psychophysical paralelism (two different forms of reality) and the identification of brain activity and the processes of consciousness (they are the same, even though they are perceived differently). Although this relation was interpreted over the centuries through religious and philosophical means, it still remains one of the most complex problems. *"Modern science explains*

*satisfactorily consciousness in the waking sense, approximates an understanding of consciousness as oriented attention and perhaps even as operation of memory. It suspects rather than knows what consciousness could mean in the sense of self-realizing. So far there has been no theory explaining consciousness in man's brain"* (Koukolík, 1992, 189). Attempts at its development are oriented e.g. toward the parallels between the consciousness and quantum mechanics in the design of the so-called physics of consciousness (Burian, 1993, 195–196), but also towards the ontological independence of consciousness and thought, the condition for which it is necessary to *"develop an independent categorial apparatus enabling an understanding of the world without making constant comparisons with the world of physical entities"* (Pstružina, 1994, 54). This way is provided by emergentism, interpreting thinking on the basis of the development of the existing but at the same time as independent and irreducible in ontological sense (unlike the physicalism preferring physical processes, and unlike mentalism explaining everything from mental processes). The pervasion of thought and experiencing is found in the endocept, e.g. in the concept of the book (which incorporates books in the library, the content of the book we read, the emotions experienced during the reading, the price paid when the book was bought, the binding touched when we hold the book, etc.). *"Endocept thus appears as a whole, it can be said as a sediment of a certain inner rich structure of experience. It is a parallel to pictograms, which contain rich information in a concentrated form"* (Pstružina, 1994, 94).

Consciousness is probably the only case in science when something examines itself because there is no objective scientific proof of the existence of consciousness (and its content) in another individual. The contents of the consciousness and their processing assume information entering through sensory channels. But too many stimuli stream through them so that only a relatively small number manifests itself in the consciousness. Under "extraconscious perception" is classified as the rest, i.e. the sensory information we are not conscious of. The relation between the extraconscious perception and the extreme states of consciousness is not simple or direct, however: *"The relation of any communicative channel to the processes shaping an experience is indirect only and its use as a criterion of the presence or nonpresence of a subjective perception is often questionable"* (Jirsa, 1992, 77). The hypothetical category of "extrasensory perception" assumes receiving of information other than sensory channels. Extrasensory (non-physical) reality has no properties of physical reality (e.g. time and space) and extrasensory perception also has different features than common perception: it crosses the time barrier, is independent of distance and space, cannot be blocked by material barriers (Parapsychologie, 1992, 4).

The role of intersubjectivity can increase e.g. as far as the conception of collective unconsciousness of Jung's archtypes. Jung believes that *"behind the consciousness there must exist a disposition unknown to the subject but nearly universal, a disposition that in all periods and in all places can create basically the same or at least very similar symbols. Since this disposition is generally unconscious in each individual, I called it* collective unconsciousness *and I postulate the existence of primeval original images, the archtypes, as the basis of symbolical products of collective unconsciousness"* (Jung, 1998, 102). Collective unconsciousness is presented as collective (not personal) structure of the psyché, such as the structural elements of the soul, which are inherited similarly as the morphological elements of the body. Its principal element are the archtypes, which appear in myths, fairytales, dreams and phantasies and are present in each of us (the main archtypes according to Jung are the shadow, wise old man, child, mother, virgin, anima in males and animus in females – the archtypes are in a way eternal although they change their form all the time). *"The archtype does not originate in physical facts, it only describes how the soul experiences physical reality. In this the soul behaves in such an autocratic way that it denies the tangible reality or says things that contract it"* (Kerényi & Jung, 1995, 78). The archtypes cannot be explained in a rational way and seized in concepts – their content is expressed primarily by metaphors, similes and symbols. *"In this area it is quite impossible to make clear distinctions and precise formulations because a certain kind of mutual pervasion is part pof the character of all archtypes"* (Kerényi & Jung, 1995, 102). Collective unconsciousness is thus a sort of an impersonal soul shared by all people and expressing itself through the personal consciousness.

Another form of intersubjective distribution is the idea of collective consciousness interconnecting the individual consciousness of people. The fact that these entities of various classes could form the singularity of social consciousness is hard to accept. *"Our difficulty in accepting the idea of some shared consciousness in the singular, which is realized in each individual consciousness, may be due to the fact that we do not realize that the two types or aspects of consciousness may belong to quite different levels of description, and still be firmly interlinked"* (Havel, 1994, 573). A similar interrelationshiop, however, is readily accepted in any relation between the species and the family, e.g. the existence of the biological species in many individuals, a match comprised of many games, language existing in many discourses. The hypothesis of the existence of a single real world is commonly accepted as well although it manifests itself only in the form of various worlds shared by the personality. Here we directly approach the old philosophical theme of species and families, discussed by Porphyrius and Boethius and surviving to these days.

The aim of this paper is not a detailed description of various models of man's psyche, but the relation between experience and possible worlds in manifestations of extreme states of consciousness

requires, in addition to pointing out the potentiality of the vision of the individual and intersubjective nature of consciousness, a brief consideration of other mental structures – rationality and emotionality. A sufficient emotional charge is a condition for any type of experiencing. *"The techniques which can directly activate unconsciousness seem to selectively strengthen the respective emotional material and enable its entry in the consciousness"* (Grof, 1993, 15). The difficulty of expressing emotionality by concepts is due to its specific feature, namely that the same stimulus can be followed by various (or no) responses. Rollo believes that man's adaptation capacity has changed in the course of time and that the vegetative level is the earliest level in man's development, was followed by the emotional level and, finally, the youngest level, the rationality. This element of development (and the anatomical and physiological basis of the limbic system, or neocortex, corresponding to it) manifests itself in the fact that emotionality is simultaneously a motivation for rationality because it activates it, produces the necessary biochemical changes in the organism, which could not be produced by rationality alone. Still more important for our theme, however, is the fact that subjectivity is made aware of within rationality but experienced within emotionality.

Rationality has become a dominant feature in the life style of western society and has been gradually suppressing emotionality. The rest of emotionality is activated by increasingly stronger means, lasts shorter and shorter – the process of acceleration and strengthening may be seen both in the work and in the relaxation of people in the West: see the increasingly loud and mechanically rhythmical music, horror films, action films containing violence, pornography, consumption of alcohol and drugs by ever younger people. For this reason, the concept of experience is less and less perceived as something quiet and beautiful, as a moral or religous zeal, enjoyment of a simple beauty. The experience is thought to be a suitable name for cheap entertainment and unusual records. Vegetative excitation and emotional ecstasy thus try to stop the process of atrophy in man's emotional life caused by the replacement of emotionality by rationality.

The extreme states of consciousness go beyond the empirically evidenced frames of consciousness and become transcendental towards rational manifestations. If we still accept that they are of some value for man and for the being in general, we are obliged to perceive them ontologically. In spite of the difficulties in this situation (inability of a rational grasp, ontological questions, contrasts of attitudes, and at the same time the impossibility of verification, the falsification due to the ontological existence of extreme experience – like in religions or myths), we will attempt defining a certain ontological relation with the hypothesis of possible worlds. This relation may be (even expressly) found in the apologists of extreme states of consciousness. E.g. Nakonečný explains the verbal inseparability of some contents of consciousness by the fact *"that there are several worlds, whose coexistence is unknown to us but which we can be known under certain circumstances, in a special way. The expanded consciousness has several degrees: some are marked by a certain objectness (seeing an aura, a phantom), others have special properties and contain a strong experience of something "numinous" (...)"* (Nakonečný, 1993, 11). The conception of other worlds in this kind of thinking is limited, however, to the division into rough matter and fine matter: *"The next world after our realm of matter, is the astral or fine-matter world"* (Ambrož, 1994, 11). (These worlds can expand until an innerly compact system arises; similarly, the Valentinovian gnosis distinguishes worlds of all thirty Aeons of the whole Plérómat) (Matoušek, 1994, 181–187). The existence of different worlds is no barrier to communication, e.g. thoughts shape some astral matter according to their character and thus produce a spectrum of thought formations. In contrast to traditional philosophy, however, these formations are given existence and a certain time for operation (varying according to the power of the thought, the frequency of its repetion, and the interrelationship). In this context it should be pointed out again that the mental world need not stand in contrast to the material world, it can be the case of two aspects of the same world. Philosophical arguments for the interrelation with possible worlds are found in Neubauer: *"by perinatal matrices" of our experience we touch the matrices of other worlds. Whenever we penetrate to them, we enter the space of possibilities from which worlds arise"* (Neubauer, 1993, 45).

Of course, the truth criterion cannot be simply taken over from logical analyses, because of the absence of rational proofs in this area, as well as because of the duality of vision in classical formal logics. There is no logical term for this property and yet there are many situations when the context of the question is such that answers yes and no are equally wrong (e.g. going beyond the binary information based on ones and zeroes in the computer memory by pushing a button). *"The switched-off state is part of the context, which is much wider than the context in which ones and zeroes are regarded as universal"* (Pirsig, 1998, 217). Another restricting factor of the logical aspect of the whole problem is the difference in the shared attitudes – e.g. noncontradictory perceiving is not enough an argument for recognition of the ontological reality of a possible world (which applies to other areas of experiences: a game will not be taken as a possible entrance into another world (of games), but as a false answer in this real world). When we admit e.g. the ontological reality of the as yet unfound parts of the spectrum of electromagnetic waves (e.g. X-rays existed in reality before they were discovered by Roentgen, and so did infrared and ultraviolet rays, radio waves, etc.), we have no right to reject the ontological reality of other possible world and extreme states of consciousness only because they have not been yet (at the end of the

20th century) physically demonstrated. When we do not reject this potentiality we will be probably unable to say how far we get get in the acceptance of different opinions. Thus e.g. unless somebody regards the burning of dry cow pats in a copper pyramid as a contribution to the solution of the spiritual and ecological crisis of mankind (Marek, 1993, 6–7) it would be inconsistent to reject this experience only because it seems nonsense to us. Thus the recognition of the ontological reality of an experience widens the ontological dignity to include phenomena standing outside any ontological consideration, as well as increases the requirement of tolerance to one and all.

The extreme states of consciousness and the experience associated with them, however, ask questions about the general conception of man and existence. If the new approach to reality is sometimes called holistic, ecological or systemic, while the present-day period is often regarded as a transition between the paradigms, extreme experience can be seen as an anomaly, being outside the common scientific paradigm, for which will reasons should be found and which should be replaced by a new paradigm. In the change of the paradigm, differences between fields, between knowledge and creation, tend to disappear. Science itself (and philosophy of science) perceives its incompleteness and therefore does not exclude as basically erroneous those concrete observations that cannot be explained by any esisting theory. On the contrary, science tries to clarify them with a new theory. A serious approach to extreme experience, however, requires formulation of a new theory as well as a really paradigmatic new approach, without prejudices and preliminary restrictions. *"Critics of experience and observations obtained during the study of extreme states of consciousness, especially transpersonal experience, are mostly unfamiliar with the facts – in a word, they are uninformed"* (Za hranice ..., 1992, 10). This is so because one cannot understand this experience without having a personal experience. "*We are surrounded by a large amount of information and opportunities for experience and we do not know it – only the person who knows how to get attuned to it, can seize these opportunities: like in a radio receiver by retuning from one station to another we get a different wave length, so we can learn to retune the experience of oneself, in which no boundaries of time and space exist. In the transpersonal state of consciousness it is not the boundaries of one's body but boundaries of sensual experience that are crossed – and one's identity is then experienced differently"* (Svobodová, 1991, 1).

In the present paradigm, these facts can be interpreted in different ways. E.g. the reincarnation experience can be explained by the survival of individual consciousness, or reincarnation of the cosmic consciousness (e.g. Brahma in hinduism), or reincarnation of the collective human consciousness. However, even such a great supporter of the reincarnation experience, as Moody, believes that all that he has established, still *"cannot define the link between the return to the past life and the old theory of reincarnation"* (Moody, 1992, 2). And even the professor of parapsychology says about the survival consciousness after death that it is *"an experience of the dying person, those individuals who were declared clinically dead and then brought back to life. Of course it is clear that these people actually were not dead. So they are unable to say: when a man dies, it looks like this"* (Parapsychologie, 3). None of the hypotheses of the survival of consciousness after death has been proved. Remeš refuses to interpret this experience as reincarnation and rather inclines to analogical explanations, such as is found in the interpretation of dreams or as *"a phantasy processing of some information which I received somewhere and which I now experience as my own. But where I took it – that remains a secret, a mystery"* (Klíč, 1995, 7). The idea of some information field as a record of experience and activities, which would be preserved outside us and from which we could deduce an objective record of actions, can be another hypothesis explaining the unusual experience and not abandoning the principles of scientific thought, e.g. by entering mystical or religious speculations. Another possibility is giving up any interpretation. In an altered consciousness there can be left what addressed the man and what influences him in his next life but it need not be explained. It is primarily experiencing, not a problem of interpretation. So no matter whether the researchers favour any of the various interpretation theories or they give up explanations and speak of a mystery, none of these specialists interested in this field denies the reality of the experience itself. The ontological reality of an experience of extreme states of consciousness is the only thing in which all those who analyze it agree.

From Czech philosophers perhaps the most enthusiastic supporter of the problems of extreme states of consciousness is Neubauer. The prestige of this issue increased when the 12th session of the World Transpersonal Conference, in Prague in June 1992, was held under the auspices of President Václav Havel and the Rector of Charles University. The International Transpersonal Association (ITA) associates thinkers, scholars and scientists who *"are dissatisfied with the traditional and to these days prevailing scientific ideas of the world, and often are in opposition to them, like the medieval heretics when they opposed the then ruling dogmas and scholastic, i.e. pedantic, scholarship"* (Svobodová & Neubauer, 1992, 7). They are a group of specialists who have no inhibitions when they discuss experiences going beyond the spheres of existing sciences and religions, who try to analyze the phenomenon of immediate experience, such as the experience of the survival of one's own clinical death, but also a similar experience – return to a past life or foreseeing events. Other themes for discussion are e.g. the great discoveries in scientific thinking (paradigmatic changes), the bridging of the gap between science and the spiritual approach to world, the transpersonal approach to psychology and therapy

as well as to political and ecological issues. These transpersonal movements go far beyond transpersonal psychology, from which they originally developed, and beyond the sciences themselves. Transpersonal orientation has thus provided *"a common ground for spiritual experience – artistic, religious, mystical – of various epochs, cultures, nations and spiritualities"* (Neubauer, 1993, 41). Neubauer mediates such contacts between sciences and the spiritual dimension (he is an erudite scholar, with great sensitivity for the spiritual, inner dimension of reality), he seeks the holistic qualities and spontaneity, the physis (i.e. naturalness) of events and does not reject postmodernism either, perceiving it as a disturber of modern myths of objectivity (and the resulting faith in objectivity as a definitive and obligatory knowledge) and progress (with its demands for the future).

The reason why science and traditional philosophy has not said anything on the issues of extreme states of consciousness for such a long time may be in the relation between the formulation and the solution of hypotheses. Pirsig develops the discussion (against the background of a motorcycle ride) on the styles of thought and approach to reality. Like many other thinkers and writers, he is guided by his effort to surpass the strictly scientific methods with their exclusively rational approach. Algorithms of the scientific method can serve well for the determination of the validity of hypotheses (by a series of experiments, observations, experiments in thinking and other scientific techniques), but they are not at all valid for the designing of new hypotheses. From the aspect of time, the scientific method is suitable for a view turned toward the past – it is *"good for testing the truth of what we take for our knowledge but it cannot tell us where we should be going, if our direction is not be a mere prolongation of the existing journey"* (Pirsig, 1998, 189). The view towards future, the formulation of new theories and hypotheses for their verification cannot dispense with creativity, originality, and intuition – the qualities standing already outside the strictly scientific thinking and a strictly rational description. Each solution is simple – from the moment when we hear what it looks like.

If in the field of extreme states of consciousness, which are outside the sphere of normal science, we propose the hypothesis of accepting experience as a means enabling entry into other worlds, we believe that we are not abandoning the field of philosophy, the task of which is and always will be asking new and new questions.

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**ONTOLOGICKÝ ROZMĚR MIMOŘÁDNÝCH STAVŮ VĚDOMÍ A TĚLESNOST**
(Souhrn anglického textu)

Analýza mimořádných stavů vědomí (perinatální prožitky a transpersonální zkušenosti) stojí mimo sféru normální vědy. Prožitek překračuje empiricky vykazatelný rámec vědomí a stává se transcendentálním vůči jeho racionální manifestaci. Autor nabízí hypotézu možných světů s důrazem na autentický prožitek v roli prostředku umožňujícího vstup do možných světů jako přijatelný ontologický koncept.

*Klíčová slova: možné světy, prožitek, mimořádné stavy vědomí.*

# HABITUAL PHYSICAL ACTIVITY IN CHILDREN ACCORDING TO THEIR MOTOR PERFORMANCE AND SPORTS ACTIVITY OF THEIR PARENTS

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Relationships between the level of physical activity (PA) and skills as well as relationships between the sports activity of parents and children were analysed in a sample of 1738 children from the 1st–3rd grades of elementary schools. Data on motor activity of children, sports activity of parents, and level of skilfulness of children rated according to their motor performance were obtained by means of a questionnaire. Relationships were evaluated by means of the Chi-square test and association coefficient. The results confirmed the higher level of motor skills in children with higher PA and, at the same time, positive relationships were recorded between the PA of children and sports activity of their parents.

*Keywords: children, parents, motor activity, skilfulness, sports activity.*

## INTRODUCTION

Ill-fated indicators of state of health are already recorded within the juvenile population. They are confirmed by the results of works alerting to the re-occurrence of respiratory diseases, allergies, overweight, obesity and physical disorders (Ciklaminiová, 1990; Thurzová, 1991). Though we understand that health is the result of co-operation of a whole range of both objective and subjective factors, it is extensively influenced by our life style. The bases of healthy habits are formed at childhood. It is evident that within this process parents dispose of high potential. From the point of view of the time influence range and priority as well as the unique character of family milieu and intensity of emotional connection between parent and child, the stimuli given by parents are more effective when compared with other influence.

The results of investigation of the level of physical and functional development and motor performance in children and youth (Moravec et al., 1990) and investigation of different daily motor routine in different groups of school-age population (Labudová & Medeková, 1990) give information on the low level of physical fitness of children with insufficient motor activity. Nevertheless, physical activity is an irreplaceable condition for a healthy physical and mental development of an individual. Systematic physical activity of reasonable quality and extent represents a very effective protective mean against civilisation diseases. Its function as a suitable content of children's free time is very important.

From this aspect, it seems relevant to look for opportunities of positive influence on the formation of habits and conditions for a healthy way of life, particularly in children and to produce more details on factors stimulating the motor activity of children. In addition to the above mentioned, results of investigation referring to different types of children in relationship to motor activity according to their mobility as an expression of an individual need for motion were rather stimulating. Motion as a biological need has its inherited predisposition. However, they may be suppressed by less and less stimulating conditions for spontaneous motor activity. With intentional suppression of the natural need of motion in children, the share of hypoactive children (manifesting small needs of motor activity) is growing as they are transferring from the group of normally active children (Kučera, 1988).

Our findings of a significantly higher occurrence of physical disorders in the groups of children rated according to their physical activity as children with small needs for motor activity (Medeková et al., 1993) and the results concerning the opportunities of a subjective rating of motor maturity of children (Havlíček, 1993) as well as Havlíček's (1982) works on socio-genetic aspects of sports activity focused our attention on the motor performance of children.

The second sphere of information accepted by our investigations were the works dealing with issues of relationships between motor activity of children and their parents. Greendorfer and Lewko (1978) found an important influence of the father upon the engagement of children in sports activities, Freedson and Evenson (1991) confirmed the relationship between the sports activity of parents and that of younger school-age children where the father – child relationship made up, for 70 % and mother – child relationship, for 66 % of cases. Though in children's

socialisation, the higher share by mothers is recognised, Snyder and Purdy (1982) confirmed the leading role of the father in the sphere of sports activities. The given finding, however, may be connected with a lower sports activity of mothers. Results of our investigation (Medeková & Zapletalová, 1984) also agree with information on parents' influence upon the sports orientation of children. According to given knowledge, a certain social heritage, an inter-generation continuity, may be supposed as well.

**The aim of this work** is to make a contribution to the extension of knowledge on socio-genetic conditionality of children's motor activity.

**Hypotheses:** The level of children's motor activity depends on the level of their skills, physically more active children belong to groups with higher level of skills.

Children of both leisure and competitive athletic parents will show a higher level of motor activity in comparison to children of non-sporting parents as the influence of fathers and competitive athletic parents on motor activity of their children is expected to be more intense.

## METHODS

The investigated sample consisted of younger school-age children from the 1st–3rd grades in elementary schools (N = 1738). The empirical research took place in 1978 with the aim to set up the demands for selection to special sport classes. Those results, published only on courses (Medeková et al., 1994), generated the source of issues presented within the grant-aided research (Havlíček: Somatic, functional, mental and motor development genesis of 6–18 years old youth).

Data on motor activity of children, sports activity of parents and the level of skilfulness in children according to their motor performance were obtained by means of a questionnaire. The motor activity of children was rated in two alternatives (children not engaged in any physical activity in addition to compulsory physical education classes and children physically active in addition to compulsory physical education classes), the level of skilfulness was rated by both teachers and parents according to the motor performance in four dimensions (extremely above-average, above average, average and under-average). A relationship analysis was applied to assess the connections between selected variables and the level of qualitative signs association was rated by means of the chi-square test and association coefficient (TABLE 1).

**TABLE 1**
Relationship between the actual motor performance of pupils and subjective evaluation of pupils' motor performance by elementary school teachers

| | Boys | | | Girls | | |
|---|---|---|---|---|---|---|
| | N | Chi-sq. | C | n | Chi-sq. | C |
| 1-st grade | 277 | 56.6 | 0.412 | 292 | 24.3 | 0.277 |
| 2-nd grade | 288 | 61.8 | 0.420 | 300 | 57.7 | 0.343 |
| 3-rd grade | 298 | 115.3 | 0.528 | 283 | 40.0 | 0.352 |

Legend: n Number of pupils
Chi-sq. $p < 0,01$
C Association coefficient

## RESULTS

An important relationship between the motor activity of children and their motor maturity rated according to their level of skilfulness (Fig. 1) was found by means of analysis of the results of our investigation. A growing number of children, the motor activity of who is limited only to school physical education classes, was found in groups with a lower level of skills. Physically less active children made up as much as 78 % of the group of children with under-average skills. On the other hand, children, whose motor activity is enriched by means of sports activities, reached a significant level in groups of children rated according to their skills as above-average and extremely above-average.

The given findings show the need for orientation to an extended engagement of children of younger school-age in sports activities. At the same time, attention should be paid to the quality of physical education at primary level of elementary schools, in particular to the group of physically less disposed children. The results of our works (Medeková et al., 1994) indicate that the given group of children is also the most dangerous one from the aspect of occurrence of physical disorders and progress at their age.

Investigations of relationships between sports activity of parents and the motor activity of children showed significant connections in the investigated traits in the relationship of both father – child and mother – child sports activities (Fig. 2 and 3). The motor activity of children in non-sporting families is, in 77 % cases, represented only by the compulsory school physical education.

Expected characteristic differences in motor activity of children from the aspect of their parents sports engagement were recorded more visibly in mothers. While the occurrence of sporting children was nearly equal in families where fathers do leisure or competitive sports, a higher percentage of children with higher motor activity was recorded in families where mothers were competitive athletes. The given results correspond with some results of the investigation (Medeková, 1984; Freedson & Evenson, 1991). They express significant connections between parents' sports activity with the motor activity of their children. In our general knowledge of a more visible father's influence in the

sphere of children's engagement in sports (Snyder & Purdy, 1982; Greendorfer & Lewko, 1978) were not confirmed.

**Fig. 1**
Level of skilfulness in children according to their motor activity

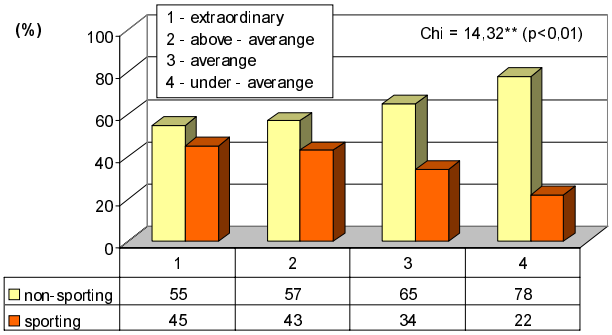



**Fig. 2**
Motor activity of children from the aspect of sports activity of father

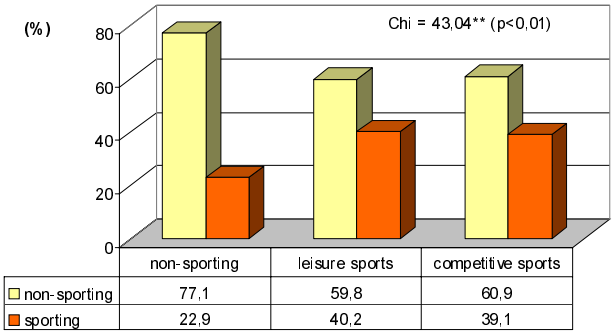
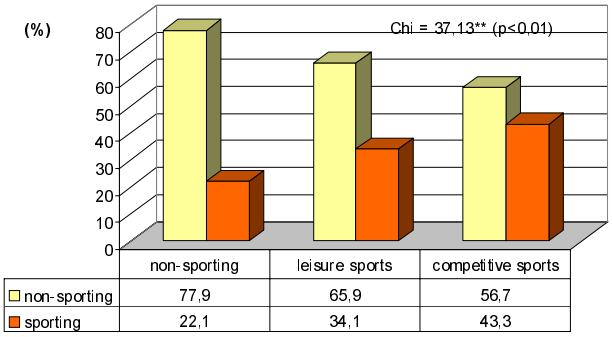



**Fig. 3**
Motor activity of children from the aspect of sports activity of mother




## CONCLUSION

An assumption of a positive relationship between the motor activity of children and the level of their motor skills were confirmed. The results document that four fifths of physically passive children are less skilful.

We confirmed that parents' engagement in sports activities influences the motor activity of their children in a positive way. Children of parents with higher/lower physical activities intend to imitate their parental pattern. A closer connection of children's motor activity to the sports life of their fathers was not confirmed.

At the same time, our investigations show the need to establish conditions for daily routine of high quality in all children, including the physically less developed, not only on part of the parents but also by the schools and sports organisations.

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**POHYBOVÁ AKTIVITA DĚTÍ Z HLEDISKA JEJICH POHYBOVÉHO PROJEVU A SPORTOVÁNÍ RODIČŮ**

(Souhrn anglického textu)

Na souboru 1738 dětí 1.–3. ročníku základních škol jsme analyzovali vztahy mezi úrovní jejich pohybové aktivity a obratnosti a vztah mezi sportovní aktivitou rodičů a dětí. Údaje o pohybové aktivitě (PA) dětí, o sportovní aktivitě rodičů a úrovni obratnosti dětí – hodnocené podle pohybového projevu – byly získány metodou dotazníku. Vztahy byly hodnoceny $X^2$-testem a koeficientem kontingence. Výsledky potvrdily vyšší úroveň obratnosti u dětí s vyšší PA, stejně pozitivní vztahy jsme evidovali mezi PA dětí a sportovní aktivitou rodičů.

*Klíčová slova: děti, rodiče, pohybová aktivita, obratnost, sportovní aktivita.*

# STRUCTURE AND LEVEL OF PHYSICAL ACTIVITY IN CHILDREN AGED 11–12 ACCORDING TO THE BODY WEIGHT[1]

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The main objective of the research was to analyze the extent, structure and character of a weekly physical activity in 11–12year old children (differentiated according to the body weight) from standard classes and to define the principal determinants for positive changes in their life style. Overweight children (apparently girls) have expressively lower level of physical activity than pupils with normal body weight. Walking was dominant and swimming the most favourite kind of physical activity in all these sets. Girls, regardless of whether being overweight or non-overweight, prefer cycling, skating (including roller-skating) and running. Boys on the same age prefer sport and motor games (football and basketball), followed by cycling and running.

*Keywords: weekly physical activity, weekday, weekend day, energy expenditure, sporting interests, prepubescent period.*

## INTRODUCTION

Considering the increasing hypokinetic routine, observed in girls and boys of Basic School age, which further increases with advancing age (Frömel, Novosad, & Svozil, 1999; Goran & Goran, 1998; Ignico, 1998; Naul & Neuhaus, 1996, and others) we regard the orientation towards prepuberty, when the children's attitude to physical activity is being developed, to be of key importance. That is why in the assessment of the efficiency of physical activity realized by children in this age group, besides substantial FITT (frequency, intensity, time, type) characteristics (Bouchard, Shephard & Stephens, 1994; Corbin & Pangarzi, 1996; McArdle, Katch, & Katch, 1991; Pangarzi, Corbin & Welk, 1996; Sharkey, 1997, and others), the structural, psychological and social aspects were increasingly emphasized. They are mainly:

- inclination of children towards a particular orientation and type of physical activity,
- connection between sports orientation based on the children's interest and the structure of their realized physical activity,
- involvement of children in organized (school and out-of-school) physical activity and its representation in the weekly motor routine,
- conditions and sources of motivation for realization of out-of-school physical activity.

The term physical activity means "... a complex behavior which generally accounts for 15 to 40 % of a person's total energy expenditure" (Bouchard, Shephard & Stephens, 1994, 9).

**The main objective of the research** was to analyze the extent, structure and character of one weekly physical activity in 11–12yearold children (differentiated according body weight) from standard classes and to define the principal determinants for positive changes in their life style. Some of our thoughts have been formulated in the following questions:

- Are children already in their prepuberty stage, like young people in puberty, less physical active on weekend days than on week days?
- What are the dominant types of physical activity in the children's week's routine?
- Does their structure correspond to their sporting interests?
- To what degree are school sports clubs and other organizations involved in the weekly physical activity of children?

## METHODOLOGY

In the survey held at selected seven standard Basic Schools in the Czech Republic and in Poland, a total of 45 girls (age 11.56 ± 0.52 years, height 153.31 ± 8.03 cm and weight 45.61 ± 11.36 kg) and 57 boys (age 11.57 ± 0.50 years, height 148.77 ± 7.57 cm and weight 40.26 ± 8.74 kg) were studied. The size and level of physical activity realized in a week's routine was monitored by standardized methodology based on the measuring of energy expenditure by Caltrac

1. From the other aspect these problems were published in science magazine The Czech Kinantropology, 1999, 2.

accelerometer (Sallis, 1994; Novosad et al., 1996) and Omron pedometer (Frömel, 1998). To the monitoring was added individual recording, during which children daily registered the type, length, character and intensity of their realized physical activity. The physical activity intensity from the individual record was determined according to the compendium (Ainsworth et al., 1993). The structure of sporting interests of children was found out by applying the standardized questionnaire of the same name (Appendix 1). For evaluation and statistical processing of the scores, special software was used (Novosad, Frömel, & Chytil, 1995; 1996), which enables supplying a didactic service for children and parents (individual results on the size of the physical activity and load, together with instructions for carrying out further physical activities), for teachers and head teachers (mean, comparative and summary results). For the criterion for classification of children according to their weight, the normal values for Czech population, set by Bláha and Vignerová, 1997, were used.

For assessment of the efficiency of a week's physical activity realized by Basic School children, according to contemporary findings (Biddle, Sallis, & Cavill, 1998; Bassett et al., 1996; Bunc, 1998; Corbin & Pangarzi, 1996; Hatano, 1993; Máček & Máčková, 1999; Pangarzi, Corbin, & Welk, 1996; Sallis & Owen, 1999, and others) and on the basis of our own findings from the monitoring of physical activity, which take into consideration also social, psychological and educational aspects, the following indices were set (TABLE 1, Frömel, Novosad, & Svozil, 1999, 122).

**TABLE 1**
The proposed indices for general orientation in judging the efficiency of physical activity of children of the prepubescent period

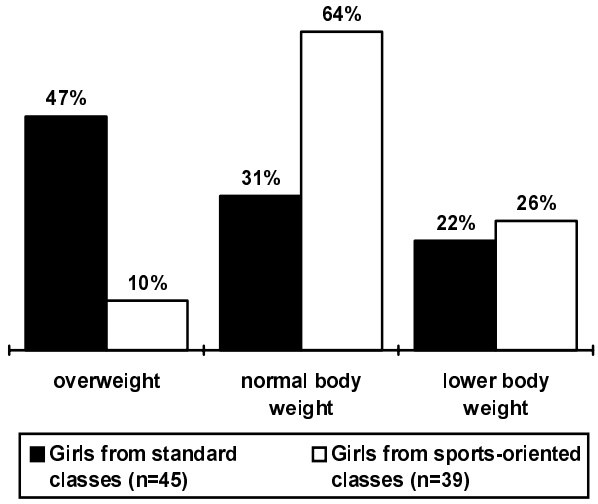
| |
|---|
| – Daily energy expenditure during one's physical activity should be, in girls, on most days of the week, at least 9 kcal•kg$^{-1}$•day$^{-1}$ and in boys 11 kcal•kg$^{-1}$•day$^{-1}$. |
| – The daily number of steps, skips and position changes should, in prepubescent girls, on most days of the week range about 11000 and in boys 13 000. |
| – The daily physical activity of girls in this age should, on most days of the week, exceed 85 minutes and of boys 95 minutes. |
| – Organized physical activity is an irreplaceable part of the total physical activity and should in girls and boys be at least 90 minutes. |
| – The daily energy expenditure due to schooled physical activity reach over 25 % all of the energy expenditure. |

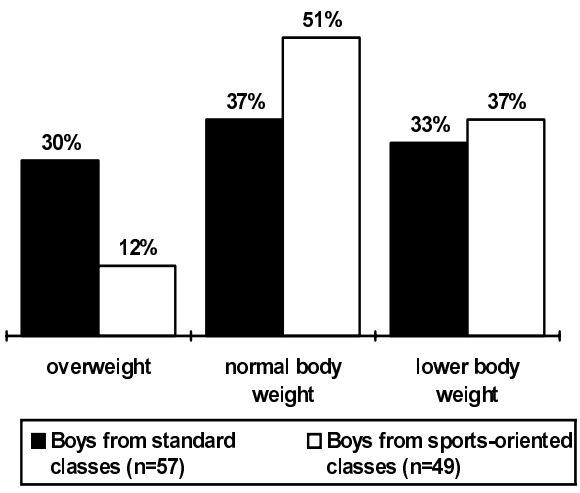
## RESULTS AND DISCUSSION

A percentage representation of children with overweight and normal weight is shown in Fig. 1. For comparison, also values for the above mentioned classification of children from sports-oriented classes, which were monitored in a similar research project, are given.

Critical is the fact that as early as in the 11–12 years' age group, nearly one half of girls and one third of boys from standard classes suffer from overweight (Fig. 1). After Ignico (1998) this overweight and the general hypokinetic routine and incorrect dietary habits, found in 40–55 % of 11–12yearold American children, which, moreover, spend some 25 hours per week watching television, are the most important source of hypertension and an unfavourable relation of HDL and LDL cholesterol.

**Fig. 1**
Classification of monitored children according to the level of their body weight (%)



In general, girls with overweight (or with normal body weight) were found to have the mean daily energy expenditure during physical activity of 428.97 ± 120.23 kcal•day$^{-1}$ (or 622.25 ± 134.08 kcal•day$^{-1}$), and in boys 653.81 ± 221.93 kcal•day$^{-1}$ (or 613.36 ± 256.94 kcal•day$^{-1}$). Because of the opportunity of a comparison between the sets under survey, the energy expenditure in physical activity is expressed by the relative value kcal•kg$^{-1}$•day$^{-1}$ ( TABLE 2).

**TABLE 2**
Mean daily energy expenditure during physical activity (kcal•kg$^{-1}$•day$^{-1}$) and number of steps, skips and position changes (n) on weekdays and on weekend days

| Sets (number) | Energy expenditure in physical activity - Caltrac (kcal•kg$^{-1}$•day$^{-1}$) | | | Steps skips and position changes Omron (number•day$^{-1}$) | | |
|---|---|---|---|---|---|---|
| | weekdays | | weekend days | weekdays | | weekend days |
| | M | F | M | M | F | M |
| Overweight girls (n=21) | 8.14 | 0.00 | 8.13 | 9578 | 0.08 | 9161 |
| F | 17.66** | | 4.23* | 4.38* | | 0.96 |
| Girls - normal body weight (n=14) | 15.26 | 2.45 | 11.89 | 12161 | 2.29 | 10583 |
| Overweight boys (n=17) | 13.17 | 0.04 | 12.75 | 12801 | 3.73 | 10738 |
| | 0.95 | | 0.97 | 0.07 | | 0.05 |
| Boys - normal body weight (n=21) | 15.28 | 0.07 | 14.75 | 13196 | 3.24 | 10460 |

Explanation: M– arithmetic mean
F – MANOVA
Statistical significance *p < 0.05, **p < 0.0005

TABLE 2 reveals in all sets of 11–12 year-old children an unfavourable, increasing trend towards lower physical activity on the weekend days than on the week days. As expected, in agreement with some foreign studies (Armstrong et al., 1998; Goran & Gower, 1998; Cheung, 1995; Naul & Neuhaus, 1996; Sallis & Owen, 1999), our prepuberty boys also have a distinctly higher level of physical activity (at F = 6.77, p < 0.05) than girls in the same age group. The warning fact is that the extent of week's physical activity realized by girls with overweight appears to be, as the existing experience shows (Frömel, 1998; Frömel, Novosad, & Svozil, 1999; Sallis, 1994), insufficient even for the mere maintenance of their existing level of fitness and sports performance. This fact is confirmed by the share of energy expenditure in physical activity in the total week's energy expenditure, whose value in these very girls is quite low (TABLE 3).

The representation of organized physical activity in the structure of week's physical activity in overweight boys, but mainly in overweight girls, is lower than it was assumed. Even when we consider the fact that walking takes up a full 45 % (or 40 %) in the total size of their weekly physical activity. In girls (or boys) with normal body weight the representation of organized physical activity in the week's routine agrees with Frömel's findings (1998).

**TABLE 3**
The level of weekly physical activity

| Sets (number) | Physical activity in week's routine | | | | | |
|---|---|---|---|---|---|---|
| | time (min) of realization | | share of organized physical activity (%) | | share in all of the weekly energy expenditure (%) | |
| | M | F | M | F | M | F |
| Overweight girls (n=21) | 669 | | 6.39 | | 23.20 | |
| | | 5.12* | | 4.73* | | 5.42* |
| Girls - normal body weight (n=14) | 853 | | 19.63 | | 30.19 | |
| Overweight boys (n=17) | 995 | | 16.45 | | 30.79 | |
| | | 1.22 | | 0.89 | | 0.21 |
| Boys - normal body weight (n=21) | 1102 | | 20.67 | | 32.38 | |

Explanation: M– arithmetic mean
F – Kruskal-Wallis
Statistical significance *p < 0.05

Both in boys and girls (Fig. 2–3 and 4–5), a very close relation is found between the structure of their sporting interests and the structure of the realized week's physical activity, as well as a higher share of household work in overweight children. In-line skating is becoming increasingly popular for girls, with no difference between various levels of body weight, as an out-of-school type of physical activity.

**Fig. 2**
Structure of weekly physical activity of girls aged 11–12-arranged according to length (min)

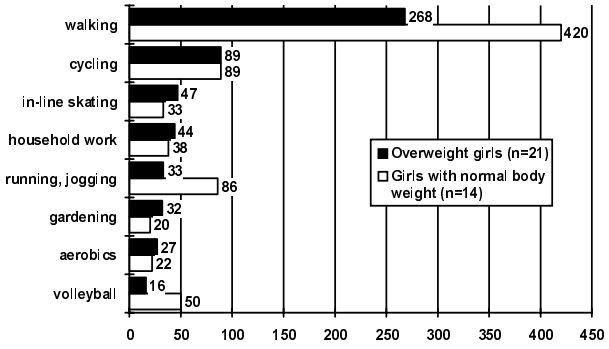



**Fig. 3**
Structure of sporting interests of girls aged 11–12-arranged according to preferences (%)

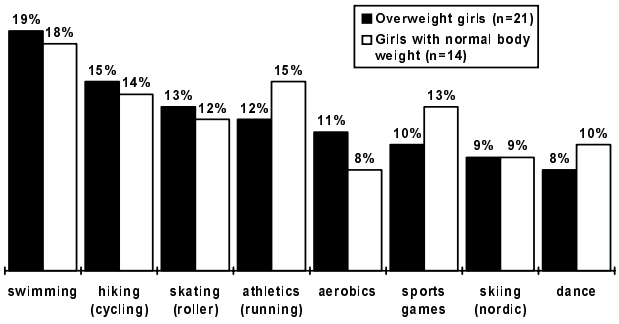


**Fig. 4**
Structure of weekly physical activity of boys aged 11–12-arranged according to length (min)

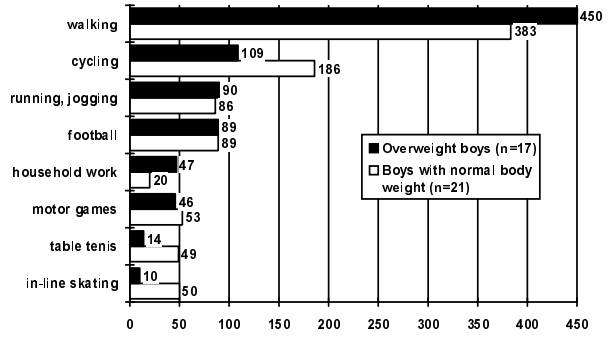
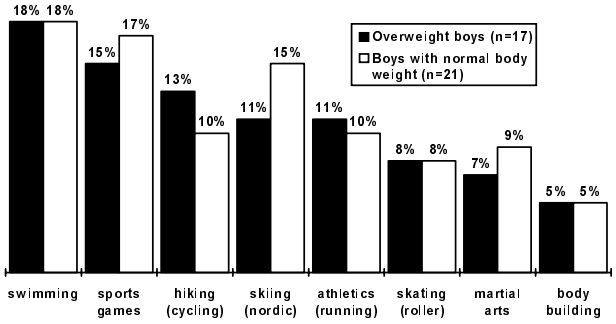



**Fig. 5**
Structure of sporting interests of boys aged 11–12-arranged according to preferences (%)




The factor of the classification of children according to their body weight level affects the structure of a week's physical activity mainly in girls, whose structure of sporting interests in this age group is less distinct than in equally old boys.

In all examined sets of prepuberty girls and boys, walking is the dominating and swimming the most popular type of physical activity. Spring (1993) in a parallel study mentions that American children in the same age group spend much less time per week walking (3–5 hours) than our children (4.5–7.5 hours). But the present condition and development of the life style not only in our society suggests that the decline in walking will not be substituted in later age by another corresponding physical activity (Armstrong et al., 1998; Frömel, Novosad, & Svozil, 1999; Ignico, 1998; Naul & Neuhaus, 1996; Sallis & Owen, 1999; Spring 1993).

Young children (with clear differences between various levels of body weight) prefer and go in for mostly such types of physical activity that can be practised outside school, outdoors, with minimal requirements for equipment and outfit (cycling, including a mountain bike, and running).

Boys in this age group in this country as well as abroad (Cheung, 1995; Naul & Neuhaus, 1996; Spring, 1993) mostly prefer sports and motor-oriented games (football and basketball), whereas the equally old, puberty-age and older girls, among whom sports games are less popular than among boys (Fig. 3 and 5), use, and do more so with increasing age (Frömel, 1998; Frömel, Novosad, & Svozil, 1999), the more aesthetic types of physical activity (mostly in-line skating, aerobic and dance). For a more efficient positive attitude of children in this age to physical activity, it is recommended to use more of the above mentioned popular and realized types of physical activity in school PE.

As expected, girls with normal body weight, unlike the overweight girls, besides the aesthetic orientation prefer, like boys, physical activities aimed at achieving good physical condition (Fig. 6 and 7). That is why, in recent years, the difference between "typically" boys' and "typically" girls' types of physical activities has been narrowing at a much faster pace. What is disquieting is the fact that the health orientation of physical activity in girls as well as in boys is little preferred in the prepuberty period.

**Fig. 6**
Orientation of physical activity in girls aged 11–12 divided according to the body weight (%)

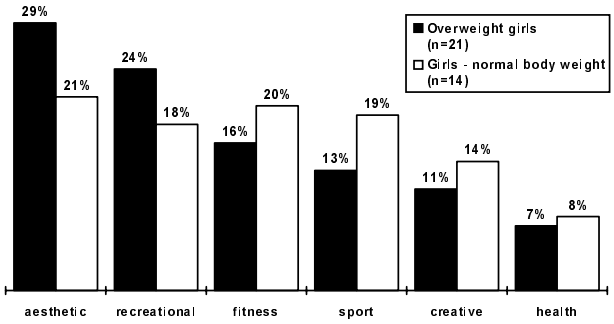
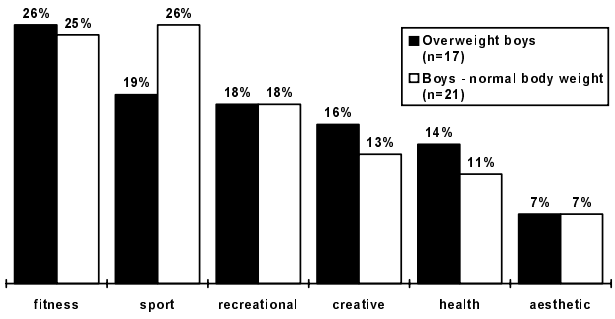



**Fig. 7**
Orientation of physical activity in boys aged 11–12 divided according to the body weight (%)




## CONCLUSIONS

- Already 11–12yearold children (more clearly those with normal weight) reveal an unfavourable trend towards lower physical activity on weekend days than on weekdays.
- As expected, overweight children (more clearly girls) are much less physical active than children with normal body weight.

- The most critical situation is found in overweight girls, whose extent of realized weekly physical activity appears to be insufficient even for mere maintenance of their existing level of fitness and sports performance.
- Walking is the dominating and swimming the most popular type of physical activity in all sets examined.
- Popular and much used types of physical activity in girls are cycling, in-line skating and running. Whereas boys in this age group clearly prefer sports and motor-oriented games (football and basketball), followed by cycling and running.
- Schools and sports clubs have a small share 6 % (or 16 %) in the week's physical activity of girls (or boys) with overweight, because the clearly predominating walking takes up a full 40 % (or 45 %).
- As expected, normal-body weight girls, unlike the overweight girls, besides aesthetic orientation prefer, like boys, physical activities oriented towards physical fitness.
- Health-oriented physical activity is little popular in 11–12year old boys and girls.
- Service feedback information on the present level of physical activity and structure of the pupils' sports interests enables schools to interfere in a more qualified way in the structure, content and course of the teaching process in Physical Education and in the out-of-school activities of the children.

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**SKLADBA A ÚROVEŇ POHYBOVÉ AKTIVITY 11–12LETÝCH DĚTÍ DIFERENCOVANÝCH PODLE TĚLESNÉ HMOTNOSTI**
(Souhrn anglického textu)

Hlavním cílem výzkumu bylo analyzovat velikost, skladbu a charakter týdenní pohybové aktivity u 11–12letých dětí (diferencovaných podle úrovně tělesné hmotnosti) ze standardních tříd a vymezit podstatné determinanty pro pozitivní změny v jejich životním stylu. Výzkumu se na vybraných sedmi základních školách v České republice a v Polsku zúčastnilo celkem 45 dívek a 57 chlapců. Pohybová aktivita realizovaná v týdenním režimu byla monitorována standardizovanou metodikou vycházející z měření energetického výdeje akcelerometrem Caltrac a pedometrem Omron, doplněna individuálním záznamem dítěte a dotazníkem sportovních zájmů. Za důležitá považujeme následující zjištění:

– Již u 11–12letých dětí (výrazněji s normální tělesnou hmotností) je patrná nepříznivá tendence k nižší pohybové aktivitě ve víkendových dnech než ve dnech pracovních.
– Nejkritičtější situaci nacházíme u dívek s nadváhou, jejichž velikost realizované týdenní pohybové aktivity se jeví jako nedostačující i pro pouhé udržení jejich stávající úrovně tělesné zdatnosti a sportovní výkonnosti.
– Chůze je dominujícím a plavání nejoblíbenějším druhem pohybové aktivity u všech sledovaných souborů.
– Oblíbenými a využívanými druhy pohybové aktivity jsou u dívek cyklistika, bruslení (včetně kolečkového) a běh. Zatímco chlapci stejného věku preferují jednoznačně kolektivní sportovní a pohybové hry (fotbal a basketbal), a dále cyklistiku a běh.

*Klíčová slova: týdenní pohybová aktivita, pracovní den, víkendový den, energetický výdej, sportovní zájmy, prebubertální období.*

**Appendix 1**
Questionnaire of interests in an area of physical activities

1. First name, surname, school, class, date:
2. Indicate your participation in any sport organization: YES NO
   Kind of sport: Level: How many hours a week:
3. Indicate your most frequent unorganized physical activity performed in your leisure time:
   How many hours a week:
4. Is in your opinion the level of your efficiency:
   BELOW AVERAGE – ABOVE AVERAGE
5. Give the order of your preferences for the first five (somewhere four) sports, activities, orientations and events separately in each part of the questionnaire.

***1. Branches of sport***
athletics (includes all forms of running)
technical sporting activities
canoeing, rowing
fitness exercise
skiing – nordic
skiing – down-hill
modern gymnastics
orienteering
swimming
aerobics
sport gymnastics
sport games
dancing
hiking and cycling
self-defence (karate, judo)
skating
windsurfing
others

***2. Gymnastics***
floor exercise
parallel bars
high bar
balance beam
rings
vault
trampoline

***3. Athletics***
running (long distance)
throw
long jump
high jump
sprint
shot put
relays
others

***4. Games***
badminton
handball
soccer
basketball
ice-hockey
"kickball" ("foot-tennis")
volleyball
softball
table tennis
tennis
water polo
others

***5. Touring***
cycling
hiking
boating
motorcycling

***6. Activities focused on***
dexterity
speed
strength
endurance

***7. Orientation***
*"aesthetic"* (stress on expression of movement by music)
*"fitness"* (development of strength, and endurance)
*"sport"* (competition)
*"recreational"* (relaxation, compensation, free time activities)
*"creative"* (creativity, independence)
*"health"* (correct body posture, stretching, weight reduction)

***8. Technical activities***
motorcross
biathlon
model-making
motoring
mountain bikes
scuba diving
sport shooting
others

***9. Swimming***
freestyle
breaststroke
backstroke
butterfly

# SPORTING VALUES AMONG EUROPE'S ELITE SITTING-VOLLEYBALL PLAYERS

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Submitted in May, 2000

This paper analyses the responses of Europe's elite male and female sitting-volleyball players. Sitting-volleyball is a team sport in which players use their hands to move and sweep on the court, while their buttocks must remain on the floor when playing the ball. Sitting-volleyball, the top sport among the disabled, recruits its best players from those with amputations and knee or ankle injuries. The data was gathered during the European Championship in Sitting-volleyball in Sarajevo in 1999 and includes 51 female and 103 male sitting-volleyball players from 13 European countries. A questionnaire, Values of Sport (VS-K95), containing 20 statements on a five-point scale, originally designed and adapted for the elite able bodied volleyball players (Krevsel, 1995), was used. With the help of factor analysis we establish the structure of sporting values among elite sitting-volleyball players. Four factors were isolated as important among women and three factors among men. The most significant factor for women was the image of personal strength and friendship, while with men the spirit of team work predominated. These findings have a particular relevance to those involved in coaching and managing the elite athletes in sitting-volleyball and some recommendations are offered to promote better understanding of participation in sport in relation to disability.

*Keywords: competitive sport, sitting-volleyball, male and female players, sporting values, physically disabled.*

## INTRODUCTION

There are good reasons for paying more attention to sport for the disabled in general, including elite sport participation. The 1987 recommendation of the Council of Europe, document No. R (86) 18 of the European Charter for Sport for All: Disabled Persons describes one of them. The document includes recommendations such as encouraging research, which will scientifically determine the physiological, psychological, social and other benefits of sport for different categories of disabled people, some of whom may aspire to participate in elite sport. Sport should become a driving force for the disabled to seek or restore contact with the world around them and thus recognition as social equals, wrote Sir Ludwig Guttmann a pioneer of sporting activities for the disabled in 1976.

Belief in the benefits of sport for disabled people has been widespread for many years and is supported by various different approaches to the subject. The fact is, however, that the entire area of sport for the disabled needs putting on a more secure, scientific footing, and this is most likely to be achieved through the implementation of a comprehensive, multi-disciplinary research programme. It is important that all the research conducted has practical value and a professional application. The values of modern top athletes partly coincide with those values represented by school, e.g. the evaluation of performance and achievement. Enlarging the scope of values refers to the necessity on the part of the disabled to extend horizons beyond the disability and the self. It implies that there are other values besides physical ones that are sufficiently attractive to excite a person's interest, for example that the person becomes interested in sports. Sitting-volleyball is a sport characterised by maximal effort and close interaction of teamwork and deep cohesion. The term teamwork universally connotes co-operation on the part of a number of individuals working towards a common goal. Co-operation exists in all parts of life and is an integral part of every success. Perhaps the greatest reward to be derived from membership of a team is the development of lasting friendship.

In both competing athletes and spectators, top sporting events provoke strong emotions, which can be either positive or negative. In both cases these emotions create sports stars, who encourage the young to take up sports activities. In recent decades, achieving top sporting results has proved to be an autonomous and autochtonous form of cultural creativity, with its own criteria of evaluation (Petrovič, Škof, & Dežman, 1996). Excellence as defined here means working with performers at national and international levels – coaching elite sportsmen and sportswomen. The elite performer will usually be highly self-motivated and willing to commit time, money and energy to reach the top. He or she will have a limited life span at this level and time will therefore be of the essence

(Campbell, 1992). Being a top athlete today presupposes a very strong commitment to sport and sport becomes a dominant factor in life (Suomalainen, Telama, & Herva, 1992). Competition is an integral part of human dynamics. Both individually and collectively none of us would get anywhere without a competitive spirit (de Swarte, 1988). Large numbers of females are entering nearly all sports, including those traditionally considered strictly male preserves. Still, we have to know more about what is really going on. This striking movement of females into sport deserves intensive research efforts. And these efforts would seem bound to be highly complex (Ryan, 1981). It must be remembered, however, that the best women in some sports can now beat good men in those sports. When women are given the same sporting advantages as men, their performances become considerably stronger. It may be that social pressures are more important than physical limitations in determining women's sporting success. However the concept of winning at all costs is probably the worst one, irrespective of the sex of the athlete. Success is a far more subtle expression and contains a finer definition of the quality of effort involved (McGown, 1994). One major problem for women is that coaching is seen from a male point of view. In general the male coach is likely to appear forceful and decisive. Therefore successful women coaches are likely to be those who adopt this style. However, the more democratic style favoured by many women may produce equally good results if it is not rejected (Beashel & Taylor, 1992).

Psychology enters volleyball through two kinds of application. The first is a partial application analysing different psychological processes, states and personalities of athletes. The second is a general application concerning the whole area of training and competition. People learn the values, attitudes and expected behaviour of the society in which they live. To date, few surveys of sporting values have been developed to describe the conditions under which elite volleyball players function (Beal, Brassey, Brown, et al., 1993; Krevsel, 1995 and 1996; Papageorgiou & Spitzley, 1996). In the study the questionnaire VS-K95 (Values of Sport, Krevsel, 1995) was used in order to explore the factor structure of sporting values among elite male and female sitting-volleyball players.

## THE MAIN AIM

This paper analyses the responses of Europe's male and female elite sitting-volleyball players relating to sporting values in order to:

- find out the structure of sporting values among female elite sitting-volleyball players,
- find out the structure of sporting values among male elite sitting-volleyball players,
- describe the common elements and existing differences between female and male elite sitting-volleyball players.

If we want to be able to highlight the role of elite disabled athletes, it is imperative to get a clear picture of the position of sporting values. When we speak of a value in the personality we refer to a basic, emotionally embedded disposition of the person to behave in terms of some abstract concept of worth. With collection of sporting values of elite male and female sitting volleyball players we intend to open new dimension to be discussed, practised and evaluated. Primarily coaches and physical educators will be able to identify and clarify prejudices, attitudes and notions about individuals with disabilities on higher level of reliability.

## METHODS

The study group (research sample) consisted of 51 female and 103 male elite sitting-volleyball players who played in the European Championship in Sitting-volleyball in Sarajevo, Bosnia and Herzegovina, in September 1999. Female respondents were from Finland (FIN, 10), Germany (GER, 9), the Netherlands (NED, 7), Latvia (LAT, 7), Lithuania (LIT, 8) and Slovenia (SLO, 10). Male respondents were from Bosnia and Herzegovina (BIH, 10), Croatia (CRO, 12), Hungary (HUN, 7), Finland (FIN, 9), Germany (GER, 12), the Netherlands (NED, 11), Norway (NOR, 4), Latvia (LAT, 5), Poland (POL, 10), Russia (RUS, 6), Ukraine (UKR, 8) and Slovenia (SLO, 9). Eligible for competition in sitting-volleyball in the European Championships are athletes with the following disabilities: amputated limbs, cerebral palsy, poliomyelitis and "les autres", which includes motor paresis or paralysis of limbs, displasia or luxation of the coxae, total endoprothesis of the knee or hips and forward/backward instability in the knee of 1.5 cm. A special classification rule is in force for female athletes which allows one player per team with no disability to take part in a sitting-volleyball game. The subject of this research is sporting values and their importance among elite male and female sitting-volleyball players. Subjects were also asked to state their sex, age, international sitting-volleyball experience, disability group, medal awards at Paralympic, World and European Championships, citizenship and the sex of their national coach.

The VS-K95 questionnaire (Values of Sport, Krevsel, 1995), which contains 20 statements, was used. The original questionnaire VS-K95 was published in Slovene language (Krevsel, V.: Odbojka – poklic športnega trenerja. Fakulteta za šport, Ljubljana). Questionnaire for the research was prepared in English and Slovene language. Respondents spoke different languages therefore they were entitled to use official championship interpreters. In this way every individual could properly understand the statements presented. The authors supervised and gave instructions when the survey was carried out.

The key meanings of the sporting values covered are: readiness to help team-mates (S01), challenging

the best teams (S02), teamwork (S03), enthusiastic atmosphere (S04), trusting oneself (S05), coming back after injuries (S06), friendship with other enthusiasts (S07), mental and physical strength (S08), proving abilities (S09), personal goals (S10), showing initiative (S11), concentrating in crucial situations (S12), competition with oneself (S13), gaining experience to lead actions (S14), control of emotions (S15), high fitness level (S16), playing experiences (S17), coming back after losing the status of a national team player (S18), the national team is my life (S19) and financial stimulation (S20). The following five-point scale was used to judge the importance of each statement when playing sitting-volleyball for the national team: 5 – extremely important; 4 – very important; 3 – important; 2 – not really important; and 1 – not important.

For statistical interpretation of factor analysis we used programme SPSS 9.0 for Windows, Principal Component Analysis, Criterion PB (Momirović, 1972) and rotation method: Oblimin with Kaiser normalization. With the help of factor analysis the structure of sporting values among elite sitting-volleyball players can be established. Four factors were isolated as important among female elite sitting-volleyball players and three factors among male elite sitting-volleyball players. These isolated factors were identified with the intention of grasping the meaning of internal values.

## RESULTS AND DISCUSSION – FEMALE PLAYERS

**F 1 – Personal strength and friendship**
The most significant statements, which determine the first factor, are:
S 05 – trusting oneself (0.731),
S 16 – high fitness level (0.712),
S 04 – enthusiastic atmosphere in the team (0.701),
S 01 – readiness to help team-mates (0.632).

Among the female elite sitting-volleyball players personal strength and friendship have essential roles among values when they play for their national teams. The highest ranking sporting values are those which favoured the trust of one's own personality and personal fitness level. Some previous findings and experiences with able-bodied female athletes show us that the socialisation elements are highly significant. A strong personality can be developed successfully primarily with the support of team-mates. A good atmosphere can be created in those situations where there is a positive energy flow from the spectators to the players and vice versa. Readiness to help each other is one of the key elements for success in team sports such as sitting-volleyball. Those who are able to help need a certain amount of physical and mental ability. Players involved in team sports know that sports results depend very much on team-mates' co-operation and support. An enthusiastic and emotional atmosphere gives women's elite sitting-volleyball tournaments a unique place in sporting competitions where there is enough space for both players and spectators to enjoy it.

**F 2 – Team leader's power**
The most significant statements, which determine the second factor, are:
S 13 – competition with oneself (0.768),
S 14 – experience to lead actions (0.694),
S 15 – controlling emotions (0.661),
S 08 – mental and physical power (0.621).

Competition with themselves is a very high ranking sporting value, even though sitting-volleyball is a team game. Factor composition enables us to predict that only a positive and psycho-physically complete player can contribute significantly to team success. Competing with one's own abilities is a very complex level of sport participation and what we understand to be top sport competition. To become a team leader a player should possess mental and physical strength, which radiates positive energy to the others in the team. How to control emotions seems to be one of major questions in sport in general and has similar implications in sport for the disabled. Top level sitting-volleyball tournaments include endless examples of extreme situations where a single point gained or lost has strong emotional repercussions. Emotional situations, which are generated and accumulated during sitting-volleyball matches, have their effects on players and reflect on their behaviour. Part of the referee's role is to deal with these highly sensitive situations, and, from what we have seen as neutral observers, this is accomplished with various degrees of success. Being able to control emotions seems to be a sign of a mature and well prepared team, and this important quality, which applies to every individual in the team, opens possibilities for success in top-ranking sitting-volleyball tournaments.

**F 3 – Sporting life style**
The most significant statements, which determine the third factor, are:
S 19 – the national team is my life (0.885),
S 02 – challenging the best teams (0.718),
S 18 – coming back after losing the status of a national team player (0.674).

Statements determining the third factor show that being a member of a national sitting-volleyball team plays an exceptionally important role in the life of female athletes. Being a member of such an important team represents a chance to be noticed and recognised outside the world of sport. The daily life of an elite sitting-volleyball athlete playing for the national team is probably more exposed in their community, with higher general expectations. For players it is very important to maintain this position, which means a higher social status and certain privileges. Strict selection usually allows for only twelve players to be

chosen to play for the national sitting-volleyball team and to have the opportunity to challenge the best teams in the world in top-level competition such as the European Championships and the World Championships. We should take into account the elite sporting reality, which is that the status of a national team member, because of many objective and subjective elements, does not last very long. For many female elite sitting-volleyball players sport is a life-long orientation and remains important after retirement from the national team. Members of the national team experience sport from different angles and know that not everything in top-level sport competition is just about being popular, admired and respected, there are also situations which involve making sacrifices, disappointments and neglect. Victory and defeat are very close indeed.

**F 4 – Top sports performer**

The most significant statements, which determine the fourth factor, are:
S 06 – coming back after injury (0.721),
S 10 – personal goals (0.696),
S 09 – proving abilities (0.689),
S 07 – friendship with other enthusiasts (0.627).

Among the female competitors in top sitting-volleyball we noticed a desire for abilities which allow comeback after injury. Injuries in sport, and sitting-volleyball is no exception, become a nightmare of every elite athlete and have undoubted influence on their sporting careers. When injuries occur we can hardly imagine how important the recovery process and re-entering the national team is for a player. Medical and therapeutic procedures are being improved all the time, but on the other hand training and competitions are becoming more and more difficult, lengthy and exhausting. Therefore we seldom meet an elite player without an injury record. When an elite player links the importance of his life with sport then we can understand the tragic consequences of an injury and the happiness after a successful comeback into the national team much better. Sporting values such as reaching personal goals and proving one's own abilities are driving forces for elite sportswomen. They do need an ambience with supporters who believe in them and share their expectations. A top sports performer never really gives up.

**TABLE 1**
Total variance explained: female players

Extraction method: Principal Component Analysis

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | % Cumulative | Total | % of Variance | % Cumulative | Total |
| 1 | 5.724 | 28.620 | 28.620 | 5.724 | 28.620 | 28.620 | 3.324 |
| 2 | 2.223 | 11.117 | 39.736 | 2.223 | 11.117 | 39.736 | 3.979 |
| 3 | 2.039 | 10.197 | 49.933 | 2.039 | 10.197 | 49.933 | 2.771 |
| 4 | 1.486 | 7.432 | 57.366 | 1.486 | 7.432 | 57.366 | 3.429 |
| 5 | 1.311 | 6.557 | 63.923 | | | | |
| 6 | 1.257 | 6.283 | 70.206 | | | | |
| 7 | 1.001 | 5.007 | 75.213 | | | | |
| 8 | .832 | 4.161 | 79.374 | | | | |
| 9 | .734 | 3.671 | 83.046 | | | | |
| 10 | .641 | 3.206 | 86.252 | | | | |
| 11 | .547 | 2.733 | 88.985 | | | | |
| 12 | .521 | 2.605 | 91.590 | | | | |
| 13 | .354 | 1.771 | 93.361 | | | | |
| 14 | .320 | 1.602 | 94.963 | | | | |
| 15 | .309 | 1.545 | 96.508 | | | | |
| 16 | .220 | 1.099 | 97.607 | | | | |
| 17 | .195 | .973 | 98.560 | | | | |
| 18 | .118 | .589 | 99.168 | | | | |
| 19 | .103 | .514 | 99.682 | | | | |
| 20 | 6.360E-02 | .318 | 100.000 | | | | |

With Principal Component Analysis, Criterion PB, we isolated four factors, which explain 57,37 % variance of the system. First factor explained 28,62 % variance of the analysed system. Four isolated factors made the interpretation and explanation of sporting values of the chosen female sitting volleyball players possible.

**RESULTS AND DISCUSSION – MALE PLAYERS**

**F 1 – Team spirit**

The most significant statements, which determine the first factor, are:
S 03 – team work (0.770),
S 04 – enthusiastic atmosphere (0.720),
S 01 – readiness to help team-mates (0.694),
S 11 – showing initiative (0.675),
S 16 – high fitness level (0.658).

The most significant statement among male elite sitting-volleyball players outlines the importance of team spirit. Teamwork is a widely recognised sporting value, especially in team games. Other values like readiness to help team-mates, initiatives in the game and care of personal fitness preparation are components which foretell players' approach to top-level sports participation. Having a strong and supportive character, besides technical competence, is the factor in an individual, which can contribute most to the development of the winning team spirit.

Quality in overall sitting-volleyball performance is determined by all players, not only those on the court, but also those sitting on the bench. An enthusiastic atmosphere stimulates players to maintain a high emotional level and concentration during the game, especially when matches of crucial importance are being played.

**F 2 – Psycho-physical ability**
The most significant statements, which determine the second factor, are:
S 08 – mental and physical power (0.753),
S 06 – coming back after injury (0.745),
S 19 – the national team is my life (0.662),
S 07 – friendship with other enthusiasts (0.655),
S 05 – trusting oneself (0.643).

There is no doubt that the physical and mental abilities of the sitting-volleyball player influence the team's performance. Can we really expect physical power from an amputee player, for example? The answer is yes, because top players have only certain movement limitations, and their psycho-physical abilities are at the level of an elite athlete. Possessing such qualities helps players to overcome obstacles widely spread around the sporting arena. If a player says that playing for the national sitting-volleyball team is an opportunity of lifelong importance to him, then coaches and team leaders can consider this specific situation and desired status. Avoiding injuries seems to be a priority among sitting-volleyball players. Therefore the psycho-physical abilities and personality qualities of a particular elite athlete create his opportunities and chances for his sporting success in his chosen activity.

**F 3 – Players' fulfilled ambitions**
The most significant statements, which determine the third factor, are:
S 13 – competition with oneself (0.686),
S 10 – personal goals (0.624),
S 09 – proving abilities (0.602),
S 20 – financial stimulation (0.596),
S 17 – playing experiences (0.556).

Male elite sitting-volleyball players have the opportunity to fulfil their sporting and other ambitions through the game. To compete with one's own physical and mental abilities always represents a challenge in sport participation. Personal goals that are suitable and achievable demand from a particular player a realistic, self-critical and constructive approach. The levels set should not be too low, nor based on illusions. Proving one's own abilities is a general value existing in all sporting competitions and plays an important role among athletes with disabilities, where there is a permanent need to prove abilities, not only those connected with sport. We believe that proving sporting abilities demands a certain standard of optimism, responsibility and readiness to work hard, otherwise opportunities have no chance of being realised. It takes many years of systematic training and competing at different levels to become an elite sitting-volleyball player. Therefore financial stimulation as part of today's increased commercialisation of sport is reflected in the attitudes of elite sitting-volleyball players. Privileges, although not dominant, are mentioned by the players in the survey; their importance may change in the future development of top male sitting-volleyball.

**TABLE 2**
Total variance explained: male players

Extraction method: Principal Component Analysis

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation |
|---|---|---|---|---|---|---|---|
| Component | Total | % of Variance | % Cumulative | Total | % of Variance | % Cumulative | Total |
| 1 | 6.228 | 31.140 | 31.140 | 6.228 | 31.140 | 31.140 | 4.452 |
| 2 | 2.263 | 11.315 | 42.456 | 2.263 | 11.315 | 42.456 | 4.379 |
| 3 | 1.284 | 6.421 | 48.877 | 1.284 | 6.421 | 48.877 | 3.338 |
| 4 | 1.160 | 5.798 | 54.675 | | | | |
| 5 | 1.063 | 5.314 | 59.989 | | | | |
| 6 | 1.024 | 5.122 | 65.111 | | | | |
| 7 | .894 | 4.468 | 69.579 | | | | |
| 8 | .830 | 4.149 | 73.729 | | | | |
| 9 | .768 | 3.838 | 77.567 | | | | |
| 10 | .692 | 3.461 | 81.028 | | | | |
| 11 | .622 | 3.112 | 84.140 | | | | |
| 12 | .530 | 2.648 | 86.789 | | | | |
| 13 | .455 | 2.277 | 89.066 | | | | |
| 14 | .447 | 2.234 | 91.300 | | | | |
| 15 | .361 | 1.804 | 93.104 | | | | |
| 16 | .337 | 1.686 | 94.791 | | | | |
| 17 | .324 | 1.620 | 96.411 | | | | |
| 18 | .318 | 1.592 | 98.002 | | | | |
| 19 | .234 | 1.168 | 99.170 | | | | |
| 20 | .166 | .830 | 100.000 | | | | |

With Principal Component Analysis, Criterion PB, we isolated three factors, which explain 48,88 % variance of the system. First factor explained 31,14 % variance of the analysed system. Three isolated factors enabled the interpretation and explanation of sporting values of the chosen male sitting volleyball players.

**CONCLUSION**

In this paper the population of elite sitting-volleyball players have been the focus of attention. Among the interviewed female elite athletes we found that:

a) Personal strength and friendship are very important aspirations and represent the leading sporting values. Social elements play a role in top sporting performances.

b) The team leader's role in sitting-volleyball is highly complex, comprising elements such as competition with oneself, experience to lead actions, control of emotions and mental and physical power. A leader of female elite players should possess the ability to direct a positive way of thinking to team-mates.
c) For most of the female elite sitting-volleyball players sport is a lifelong orientation and remains important after retirement from the national team. The sporting lifestyle has its roots in early childhood, where parents, friends, teachers and later coaches create and direct it. Today it is a synonym for a healthy and sensible way of live.
d) Injuries in sport, and sitting-volleyball is no exception, are the nightmare of every elite athlete. Sporting values such are reaching personal goals and proving one's own abilities are driving forces for elite sportswomen. To keep a position in the national sitting-volleyball team is certainly one of the priorities among female elite players.

Among the interviewed male elite sitting-volleyball players we found that:
a) The importance of teamwork prevails among male elite sitting-volleyball players and their understanding of sporting values. Teamwork is one of the universal values significant at all levels of sport participation, and this is emphasised among disabled sportsmen. The character of an individual, along with technical achievement, is essential to the team development.
b) Both the mental and physical abilities of sitting-volleyball player have a strong influence on individual and team performance. This psycho-physical strength is also the most important factor in avoiding injury problems.
c) Male elite players use the opportunity to fulfil their personal ambitions through sitting-volleyball competitions. For the elite athletes there is a permanent need to prove abilities, and not only those connected with sport. It takes years of systematic preparation to become an elite sitting-volleyball player. Privileges, including financial ones, are not dominant but have some influence on the players in the survey.

The similarities and differences between female and male elite sitting-volleyball players were as follows:
a) The common statements for both female and male elite sitting-volleyball players are those which determine isolated factors such as the enthusiastic atmosphere, readiness to help team-mates, high fitness level, mental and physical strength, coming back after injuries, the national team is my life, friendship with other enthusiasts, trusting oneself, competition with oneself, personal goals and proving one's own abilities.
b) The statements that form factors only for male elite players are team work, using initiative, financial stimulation and playing experiences.
c) Only female elite players select experience to lead actions, controlling emotions, challenging the best teams and coming back after losing the status of a national team player.

This study has attempted to answer the basic question of the structure of sporting values among Europe's elite sitting-volleyball players, but we can also use these results for comparison and new ideas in investigating the situation for other athletes with disabilities. The most significant factor for females was the image of personal strength and friendship, while for male athletes it was the spirit of teamwork. Presenting the structure of the sporting values of elite sitting-volleyball players will provide useful information for coaches and others who are involved either with this specific game or with sports for the disabled in general. More knowledge on sporting values means better chances for success in a chosen sporting activity. Achieving success is a key factor in top sporting events and sport for the disabled is part of this demanding area. The future development of sitting-volleyball is also based on systematic observations and research. The international scope of the study should be noted as the players represented 13 European countries. We believe that this research will contribute to the enrichment of knowledge in the field of sport and especially in the field of sport for people with physical disabilities. Through this specific sport, sitting-volleyball, we hope to be making a contribution to sport for the disabled in general.

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**SPORTOVNÍ HODNOTY MEZI EVROPSKÝMI VRCHOLOVÝMI HRÁČI SITTING VOLEJBALU**
(Souhrn anglického textu)

Tato studie analyzuje odpovědi vrcholových evropských hráček a hráčů sitting volejbalu. Sitting volejbal je týmová hra, při které se hráči pohybují po kurtu pomocí rukou; při odbíjení míče musejí hýždě zůstat ve styku s podlahou. Sitting volejbal, jeden z nejoblíbenějších sportů mezi tělesně postiženými, získává své nejlepší hráče mezi postiženými s amputací končetiny nebo se zraněními kolen a kotníků. Údaje byly pořízeny během Mistrovství Evropy v sitting volejbalu v Sarajevu roku 1999 a zahrnují 51 hráček a 103 hráčů sitting volejbalu ze 13 evropských zemí. Dotazník o sportovních hodnotách (VS-K95) obsahuje 20 prohlášení a sportovci se k nim vyjadřují pomocí pětibodové stupnice. Tento dotazník byl původně koncipován a používán pro vrcholové hráče volejbalu bez zdravotních omezení (Krevsel, 1997). Pomocí faktorové analýzy jsme vytvořili skladbu sportovních hodnot mezi vrcholovými hráči sitting volejbalu. Jako nejdůležitější byly u žen vyčleněny čtyři faktory, u mužů to byly faktory tři. Nejdůležitějším faktorem u žen byla představa vlastní osobní odhodlanosti a přátelství, zatímco u mužů převažoval pocit týmové spolupráce. Tyto závěry jsou obzvlášť důležité pro ty, kteří se zabývají vedením a trénováním vrcholových hráčů sitting volejbalu, a pomáhají lépe pochopit význam sportovní činnosti ve vztahu k tělesnému postižení.

*Klíčová slova: soutěžní sport, sitting volejbal, hráčky a hráči, sportovní hodnoty, tělesně postižení.*

# APPLICATION OF AGE-STANDARDISED PARAMETERS IN THE EVALUATION OF SA HRV IN CLINICAL PRACTICE

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Submitted in April, 2000

A new approach in the evaluation of heart rate variability (HRV) is suggested by virtue of factor analysis, analysis of variance and correlation coefficients between parameters of spectral analysis (SA) heart rate variability and age. The reduced number of parameters were divided into three groups: age-dependent (increasing with age), age-dependent (decreasing with age), and age-independent.

The reference values were established by virtue of the following procedure: 50 % and 95 % prediction intervals for linear regression were determined in age intervals changing with age. Where the age dependent intervals changes were insignificant, the values were calculated as 2.5 %, 25 %, 75 %, and 97.5 % quantiles of normal distribution; the same procedures were used for parameters independent of age in which averages and standard deviations were calculated.

The above mentioned evaluation of SA HRV was used in 35 registered patients with diabetes mellitus ranging in age from one to 17 years. Most of the values amongst the group of patients are negative, hence the group consisted of those with more or less disturbed functions of the autonomic nervous system. The lowest average values were calculated from parameters derived from the LF component. The parameters calculated from VLF component in standing were also expressively negative.

In as much as the average values for parameters inferred from the HF component are low, the results could be interpreted in terms of abnormal values of selected parameters of SA HRV.

In conclusion, the major significance of the new evaluation of SA HRV in clinical practice is based on easier interpretation of the power spectrum in individual patients. The changes in HRV spectra due to NIDDM are parallel to the changes connected with age. Therefore, we could not correctly interpret one-time evaluation of SA HRV without age adjustment.

*Keywords: spectral analysis of heart rate variability, methodology of evaluation, age, diabetes mellitus.*

## INTRODUCTION

It is generally accepted that HRV gradually decreases with age and that such a dependence specifically affects not only total spectral power but also its individual components. (Byrne et al., 1996; Fluckiger, 1999; Jensen-Urstad et al., 1997; Piccirillo et al., 1996; Simpson et al., 1988; Weise et al., 1991; White et al., 1997). Although the results of tests focused on the effects of increasing age on the HRV spectrum using postural changes are ambiguous, they seem less pronounced in older subjects both in the parasympathetic and sympathetic branches (Byrne et al., 1996; Finley et al., 1986; Ingall et al, 1990; Lakatta, 1993; Malik & Camm, 1995; White et al., 1997; Ziegler et al., 1991).

In patients with cardiac, metabolic, neurological and some renal diseases, the spectral power of HRV is reduced as well; because these disorders are, along with ageing, related with a decline in vagal activity. It is necessary to define the overlapping area of reduced HRV between healthy older subjects and patients having one of the above disorders, and thus set clear criteria for establishing limitations separating these groups. For this to be accomplished, it is necessary to determine the distinction between physiological changes accompanying ageing and pathological changes in HRV (Osterhues et al., 1998). It isn't necessary to only include the influence of age in a longitudinal study, when influence of some types of stimulation (one-time or chronic influence of medicaments, temperature, altitude, training etc.) on the spectral power of HRV in the same subject is evaluated. In the inter-individual comparison of HRV spectral power in subjects with differing age, and in older subjects, adjustments relating to age are necessary.

It was proved that HRV spectral power in patients with diabetes mellitus is reduced. This reduction is often associated with latent or clinically established diagnosis of diabetic autonomic neuropathy (DAN) (Ziegler et al., 1994). Patients with diabetic autonomic neuropathy have an increased cardiovascular mortality rate when compared to healthy individuals or diabetic patients without DAN. Progression of DAN is significant during the first two years subsequent to its discovery. This was defined by a deterioration in the mean values of HRV indices and standard cardiovascular autonomic function tests, and by the appearance of autonomic symptoms in some patients. (Karamitsos et al., 1998). Standard cardiac autonomic tests only allow evaluation of overall activity of ANS. Spectral analysis (SA) HRV offers simultaneous quantification of sympathetic and parasympathetic activities, due to which it can also measure their instantaneous balance (Bellavere et al., 1992). This methodology also allows correct diagnostic changes in the ANS rather than from standard neurological assessment.

In lieu of a relatively high number of individual HRV indices (there are 32 indices), some are age dependent, while others are not. The aim of this study was to incorporate similar indices and agreeable age dependence into complex factors so as to simplify the use of SA HRV in clinical medicine, to simplify their description and interpretation. The aim of our study was to apply this new methodology of evaluation of SA HRV on a group of patients with expected changes in ANS.

## SUBJECTS AND METHODS

The methodology of evaluating SA HRV was based on the results of examination of 222 subjects (143 male and 79 female) aged 12 to 70 years chosen from approximately 800 subjects who were examined in the laboratory of exercise physiology. Elimination was carried out on the basis of usual clinical and laboratory criteria and the selected candidates corresponded to the criterion of healthy persons.

The HRV examination complied with the following testing protocol: The examination began between 8 and 9 a.m. Subjects have a lay in a quiet room with their eyes closed for the purpose of isolating their sensual perception and wear headphones playing relaxing music. A 5 minute ECG was recorded after five minutes of lying in the rest position on a tilted table. The subject was then made to stand vertical and after one minute of standing, a 5 minute ECG was recorded again. The subject was then made to lie down again and, after reaching a steady state; a 5-minute ECG was recorded. The first position, supine at rest, served only for the purpose of standardizing the examination and its results were not taken into consideration. The ECG curve was monitored at all times (to exclude ectopic rhythms and blockades). To monitor ECG signal and calculate SA HRV parameters, we used an original hardware and software microcomputer system VARIAPULSE TF 3.

A basic calculated parameter of the SA HRV, which serves for derivation of a number of other parameters, is Power Spectral Density (PSD) [$ms^2.Hz^{-1}$] It is defined for individual frequency ranges: high-frequency (HF) (150–500 MHz), low-frequency (LF) (50–150 MHz) and very low-frequency (VLF) (20–50 MHz).

The following indices were calculated for all of the above mentioned components:

- integral level of the power spectrum $P_{VLF}$, $P_{LF}$, and $P_{HF}$ [$ms^2$],
- overall value of HRV evaluated by the total spectral power $P_t$ [$ms^2$],
- the relative part of individual components of total power % VLF, % LF a % HF [%],
- ratios of the values of the individual components VLF/HF, LF/HF, VLF/LF,
- the variation coefficient of individual components and of total spectral power $CCV_{VLF}$, $CCV_{LF}$ a $CCV_{HF}$ (Hayano et al. 1991).

Non-normal distributed parameters (as determined by Kolmogorov-Smirnov test) were transformed to their natural logarithms, which resulted in the facilitation of additional statistical manipulation.

With regards to the above distribution of data, we used the Spearmann coefficients for simple correlation analysis between individual parameters and age. Further, analysis of variance in all parameters was performed.

Factor analysis was used in order to determine the relationships between the parameters. Corresponding courses of age dependency of parameters incorporated into one factor was verified by means of analysis of variance and unsuitable parameters were eliminated. On the basis of factor loads and correlation coefficients in age-dependent parameters, only one parameter was separated (that is "representative of the factor") from all parameters incorporated into the factor (TABLE 1). According to the relation between parameters and age, the parameters were divided into three groups:

- age-dependent (increasing with age),
- age-dependent (decreasing with age),
- age-independent.

**TABLE 1**
The factors and included parameters. **L** = lying, **S** = standing, HF = high frequency, LF = low frequency, VLF = very low frequency, P = power, CCV = coefficient of variance of component

| **Factors** | "Representative of the factor" | **Included parameters** |
|---|---|---|
| F1 | **L** $CCV_{HF}$ | **L** $P_{HF}$, **L** $P_t$ |
| F2 | **S** $CCV_{LF}$ | **S** $P_{LF}$, **S** $P_t$ |
| F3 | **S** $CCV_{HF}$ | **S** $P_{HF}$ , **S** %HF |
| F4 | **L** LF/HF | **L** %LF |
| F5 | **L** VLF/HF | **L** %VLF, **L** VLF/LF |
| F6 | **S** $CCV_{VLF}$ | **S** VLF/HF, **S** VLF/LF, **S** %VLF |

The entire age spectrum was spread over into 15 groups so that the number of subjects in the group would not be less than 10 or higher than 24. Average and standard deviations for each age-dependent parameter in the said age-groups were calculated and recorded in the form of graphs. Afterwards, those age groups were marked in which changes in the course dependency line of the parameter of age occurred; it implies that age-dependent regression of the parameter changes course and differences between the age groups were not significant.

The results of visual evaluation were verified by testing of significance of the estimated relation (that is dependence or independence) (see above) in the adjacent age groups by means of Kruskal-Wallis test. Thus, the age interval for any individual parameter, where the differences between age groups were either most pronounced or insignificant, was estimated. The linear regression was calculated for the age intervals where a significant change in the age parameter occurred. In intervals where the parameter did not change with age, only average and standard deviations were calculated.

Reference values were established by virtue of the following procedure: There were determined 50 % and 95 % prediction intervals of linear regression in the age intervals changing with age. In the age intervals changing with age insignificantly, it was calculated as 2.5 %, 25 %, 75 %, 97.5 % of normal distribution; the same procedures were used in parameters independent of age where averages and standard deviations were calculated.

In the parameters changing with age, the values within 50 % prediction intervals (between 25 % and 75 %) were regarded as physiologic, between 75 % and 95 % (or 25 % and 5 %) prediction intervals as border-line, and outside 95 % (or under 5 %) prediction intervals as not normal (pathologic). A similar procedure was used in the parameters without dependence on age; e.g. values between 25 % and 75 % are normal, that is physiologic, values between 75 % and 97.5 % (or 25 % and 2.5 %) as border-line, and outside of 97.5 % (or under 2.5 %) as not normal (pathologic).

These values were transformed into a point-score: the physiologic extent was established between –2.5 and +2.5 points, border-line values between –4.75 and –2.50 points and between +2.50 and +4.75, and above +4.75 (or under –4.75) were taken as abnormal (pathologic) values.

The above mentioned evaluation of SA HRV was used in 35 patients aged 38 to 78 years (17 male and 18 female) a one to 17 years history to established diabetes mellitus. 23 of these patients were treated with oral antidiabetic medications, whereas the others with insulin. Six patients suffered from nephropathy, 5 patients from retinopathy, 4 patients from neuropathy and 4 patients exhibited myocardial infarction. Aged standardized values of parameters were expressed as average and standard deviations. Relationship between standardized values of parameters and other patient's data was defined by correlation coefficients.

## RESULTS

The average and standard deviations of age, duration of diabetes, blood glucose, plasma triglycerides, total cholesterol, HDL-cholesterol and LDL-cholesterol in the study group are shown in TABLE 2. The standardized values of 16 parameters after reduction (see above) used for evaluation of the SA HRV are presented in TABLE 3. Most of the values in the group of patients are negative (94 %), hence the group consisted of those with more or less disturbed functions of the autonomic nervous system. The lowest average values (< –2.5) were calculated from parameters inferred from LF component both in standing (**S** $CCV_{LF}$, **S** % LF a **S** $P_{LF}$) and in lying positions (**L** $P_{LF}$). Parameters calculated from the VLF component in standing (**S** $CCV_{VLF}$, **S** VLF/HF) were also negative.

**TABLE 2**
Basic characteristics of the study group

| | **X** | **SD** |
|---|---|---|
| age (years) | 58.63 | 9.30 |
| disease duration (years) | 5.71 | 4.71 |
| blood glucose (mmol.$l^{-1}$) | 8.20 | 2.77 |
| triglycerides (mmol.$l^{-1}$) | 2.21 | 1.30 |
| cholesterol (mmol.$l^{-1}$) | 5.78 | 0.99 |
| HDL – cholesterol (mmol.$l^{-1}$) | 1.14 | 0.39 |
| LDL – cholesterol (mmol.$l^{-1}$) | 3.64 | 0.83 |

**TABLE 3**
Basic characteristics of the standardized SA HRV parameters

| Parameter | x | SD |
|---|---|---|
| **L** $P_t$ | -3.04 | 2.30 |
| **decreasing with age** | | |
| **L** $CCV_{HF}$ | -2.47 | 2.67 |
| **L** %HF | -0.15 | 3.20 |
| **S** $CCV_{LF}$ | -4.11 | 1.88 |
| **S** $CCV_{HF}$ | -2.51 | 2.93 |
| **increasing with age** | | |
| **L** LF/HF | -0.26 | 2.85 |
| **L** VLF/HF | -1.65 | 2.70 |
| **S** LF/HF | 2.27 | 2.67 |
| age-independent | | |
| **S** %LF | -2.84 | 2.43 |
| **S** VLF/HF | -3.74 | 1.71 |
| **S** $P_{VLF}$ | -2.50 | 2.53 |
| **L** $P_{VLF}$ | -2.26 | 2.28 |
| **L** $P_{LF}$ | -3.26 | 2.39 |
| **S** $CCV_{VLF}$ | -2.56 | 2.45 |
| **L** $CCV_{VLF}$ | -1.67 | 2.34 |
| **L** $CCV_{LF}$ | -3.02 | 2.29 |

In as much as that the average values of parameters inferred from HF component are lower than –2.5 points (**L** $CCV_{HF}$, **S** $CCV_{HF}$), the results could be interpreted in terms of abnormal values of selected parameters of SA HRV.

Significant negative relationships between the length of the disease and age, and values of some standardized parameters were established by correlation analysis (TABLE 4). Age dependency was established for six from eight age-independent parameters, and also for three age-dependent parameters. The course of the disease has influenced total spectral power and most of the age-independent parameters. The partial components of HRV and its proportion on total spectral power (they aren't dependent on age) were not influenced by the length of the disease.

The major significance of the new evaluation method of the SA HRV in clinical medicine is based on easier interpretation of the power spectrum in individual patients. We present two examples for comparison SA HRV between two patients. The first example presents the spectrums of two female diabetics approximately of the same age (58 and 57 years). Both patients have established diabetes mellitus roughly for the same period (2–3 years). It is visible that the spectral power in the first patient on the right was higher than in the second (Fig. 1). The first patient had most parameters in the physiologic range (> –2.5), while most parameters in the second patient were conversely below standard range (< –4.5) (Fig. 2). From the point of clinical evaluation, the first patient was evaluated as being better than the second.

**TABLE 4**
Correlation between standardized parameters of SA HRV, age and duration of disease (DG).
$p < 0,05$ = *, $p < 0,01$ = **, $p < 0.001$ = ***, NS = non significant

| Parameter | age | DG |
|---|---|---|
| **L** $P_t$ | -0.58 *** | -0.37* |
| **decreasing with age** | | |
| **L** $CCV_{HF}$ | -0.49** | NS |
| **L** %HF | NS | NS |
| **S** $CCV_{LF}$ | -0.40* | NS |
| **S** $CCV_{HF}$ | NS | NS |
| **increasing with age** | | |
| **L** LF/HF | NS | NS |
| **L** VLF/HF | NS | NS |
| **S** LF/HF | NS | NS |
| age-independent | | |
| **S** %LF | NS | NS |
| **S** VLF/HF | NS | NS |
| **S** $P_{VLF}$ | -0.39* | -0.42* |
| **L** $P_{VLF}$ | -0.53** | -0.53** |
| **L** $P_{LF}$ | -0.53** | -0.36* |
| **S** $CCV_{VLF}$ | -0.41* | -0.50** |
| **L** $CCV_{VLF}$ | -0.51** | -0.60*** |
| **L** $CCV_{LF}$ | -0.46** | -0.39* |

Another example of two patients with varying age: The first one was 71 years at the time of test and had established diabetes mellitus for 13 years. The second patient was younger by 19 years and he has been registered in a diabetic clinic for only one-year. The differences between the three-dimensional graphs are not quite clear and convincing, hence we could not correctly interpret them without age adjustment (Fig. 3). The older patient had most of the age-standardised values of HRV in the physiologic range. The younger patient with short-term diabetes mellitus had all parameters in pathologic, below standard, range (Fig. 4). Also in this case clinical evaluation and biochemical markers correspond with the SA HRV evaluation – the older diabetic was better stabilised and the status of the disease was obviously better than in the younger one.

## DISCUSSION

This pilot study presents a new methodology for evaluation of SA HRV by age-standardised parameters. It was applied on patients with NIDDM.

Ziegler et al. (1992) have shown that total spectral power, influenced by sympathetic and parasympathetic activity, is a more sensitive diagnostic indicator than the standard Ewing's tests. It demonstrates the importance of examination of diabetic patients by SA HRV. In our study, we detected the lowest values for parameters inferred from the LF component both in standing and in lying. We could ascertain that the

**Fig. 1**
Three-dimensional graphs of two diabetic patients of same age and duration of disease

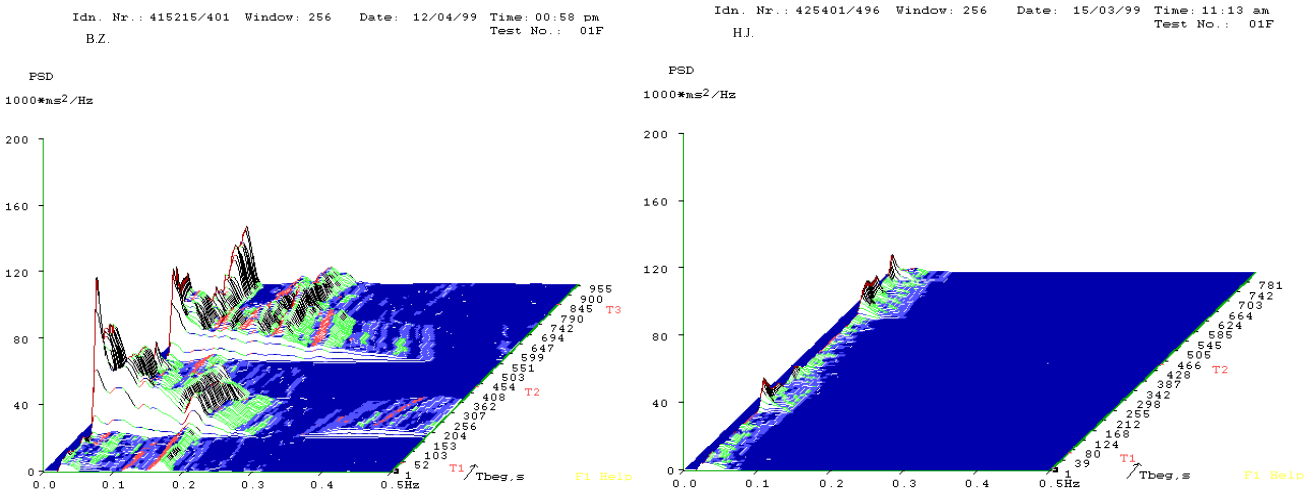



**Fig. 2**
A graph of eight age-standardized parameters of SA HRV. Two diabetics patients of the same age

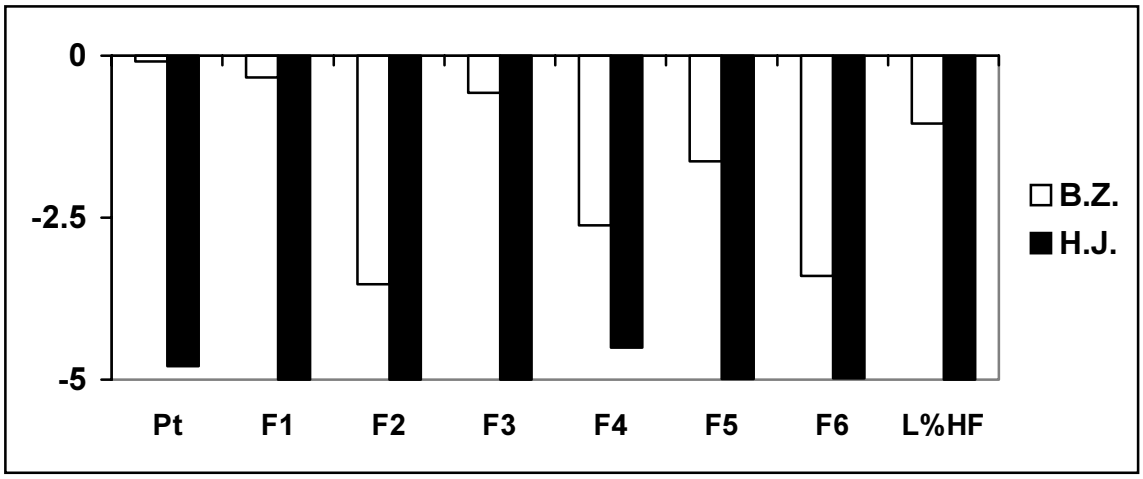


**Fig. 3**
Three-dimensional graphs of two diabetic patients with significantly different age and duration of disease

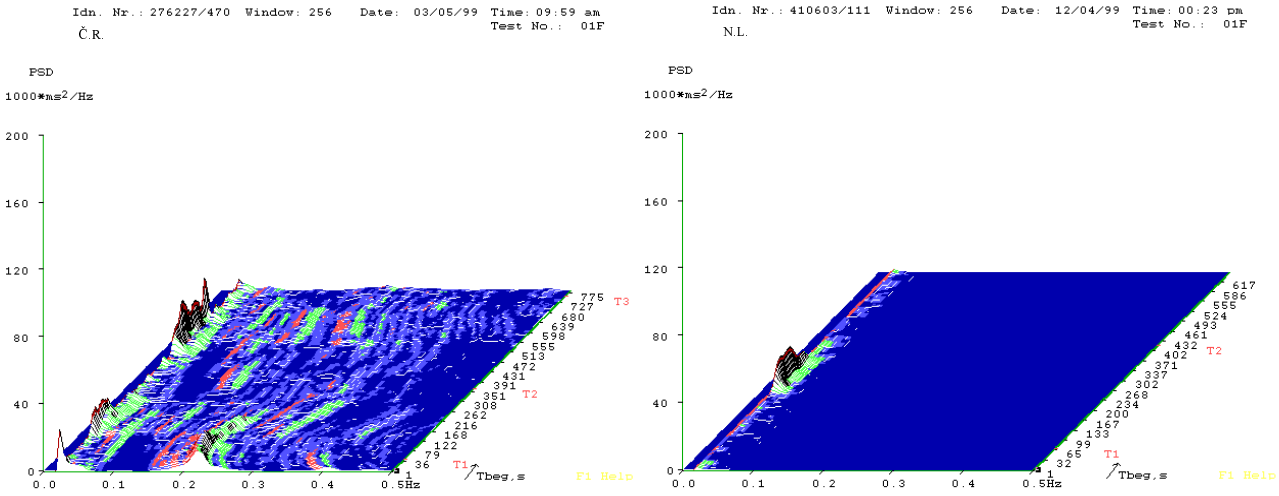
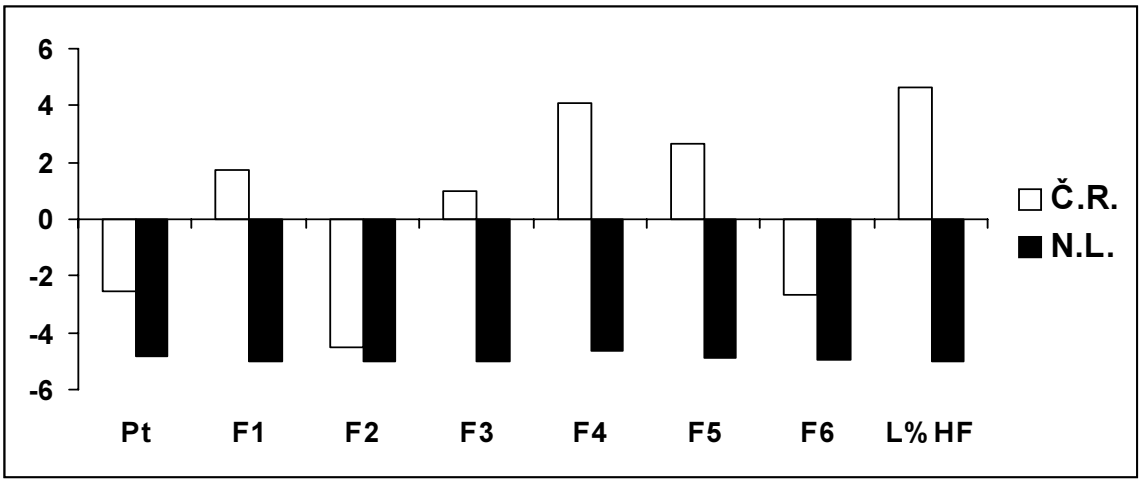



**Fig. 4**
A graph of eight age-standardized parameters of SA HRV. Two diabetics patients with different age and duration of disease




total spectral power, connected mostly with baroreceptor activity, was reduced in our patients by virtue of these results. This reduction was not dependent on body position. Howorka et al. (1998) have also shown that cumulative spectral power of total frequency band and spectral power of low-frequency band during supine position prove to be the most selective and discriminating among patients in different stages of autonomic neuropathy. This study wasn't engaged in age-standardization, because it was conducted on patients of the same age. Also, Lanting et al. (1990) found that the power of LF was lower in diabetic patients. Their results show a shift of the LF frequency in diabetic patients to a lower value compared with control subjects. Authors have introduced a time delay in the control loop, which is the main frequency-determining component, and so the shift in the LF frequency could be explained by an increased time delay caused by sympathetic dysfunction. The conclusions from both studies emphasize the importance of monitoring LF component dynamics. It corresponds also with the results of our study.

It is known that DAN is associated with reduced autonomic supply to the heart, which can be estimated by a decrease in heart rate variability (Howorka, 1997; Molgaard, 1994; Yamasaki, 1992). Since this reduction in HRV can precede clinical expression of DAN, it is evident that detailed analysis of the HRV spectra is important. Early detection complications of disease are important because these complications may influence other manifestations of the disease or its outcome and thereby improve prognosis.

In our study, we established significant negative co-relations, which exist between series of standardized parameters and age. In healthy subjects, the majority

of the age-independent parameters (in particular VLF parameters) were significantly lower in older diabetics when compared with the younger patients. Age-dependency was also established in age-adjustment parameters, which were connected with reduced parasympathetic activity. We interpret this finding in conjunction with significant relationship between age-independent parameters of SA HRV and duration of the disease: the older the patient, the longer was duration of the disease, and greater was the reduction in spectral power. Changes in HRV spectra due to NIDDM are parallel with changes connected with age and accent it. Therefore, we could not correctly interpret one-time evaluation of SA HRV without age adjustment.

Rollins et al. (1992) have suggested significant negative correlation's between HRV and duration of the disease. Yamasaki et al. (1992) have only found a correlation between duration of the disease and HF component. Our results have demonstrated that gradual degradation in the total HRV spectra is induced by duration of the disease. A significant relationship was not established between the duration of diabetes and the parameters, which express relative parts of individual components of total power. Lanting et al. (1990) have also established a relationship between age and total HRV power, but only in a group of diabetic patients.

These case studies confirm that we could not correctly evaluate the results of SA HRV based only on three-dimensional graphs or individual parameters without age adjustment.

## CONCLUSION

SA HRV is often adjudged to be a methodical tool in evaluating autonomic activity in some diseases, in particular NIDDM and heart diseases. Since these disorders are, along with ageing, related to similar changes in the SA HRV, it is necessary to define the overlapping area of reduced HRV between healthy elderly subjects and the patients and thus set clear criteria for establishing limitations separating these groups. For this to be accomplished it is necessary to determine the distinction between physiological changes accompanying ageing and pathological changes in HRV.

The results of this pilot study are expressively limited by the number of evaluated subjects and it will be necessary to raise significantly the number of tested patients.

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**APLIKACE HODNOCENÍ SPEKTRÁLNÍ ANALÝZY VARIABILITY SRDEČNÍ FREKVENCE POMOCÍ VĚKOVĚ STANDARDIZOVANÝCH PARAMETRŮ DO KLINICKÉ PRAXE**

(Souhrn anglického textu)

Na základě faktorové analýzy, analýzy rozptylu a jednoduché korelace mezi hodnotami ukazatelů spektrální analýzy (SA) variability srdeční frekvence (HRV) a věkem byl navržený metodický postup nového hodnocení spektrálního výkonu HRV. Uvedený metodický postup byl aplikován na soubor dat, získaných vyšetřením SA HRV u souboru 222 zdravých osob obou pohlaví ve věku od 12 do 70 let. Redukovaný počet ukazatelů (50 % původního počtu) byl rozdělen do tří skupin: Do první skupiny byly zařazeny ukazatele, jejichž hodnota s věkem klesala, ve druhé stoupala a ve třetí se s věkem neměnila. Po statistickém vyhodnocení takto upravených dat byla vytvořena pásma referenčních hodnot, která umožňují vyhodnocení jednotlivých věkově závislých i nezávislých ukazatelů.

Tento postup hodnocení SA HRV byl uplatněn ve skupině 35 pacientů s diagnostikovaným NIDDM (17 mužů a 18 žen) ve věku 38 až 78 let. U většiny pacientů došlo k nejvýraznějším změnám v celkovém spektrálním výkonu a u ukazatelů, odvozených od komponenty LF, zobrazující aktivitu baroreceptorů; k významné redukci standardizovaných hodnot však došlo i u velké části ostatních věkově závislých i nezávislých ukazatelů. V souboru byl rovněž prokázán negativní vztah mezi registrovanou délkou onemocnění a celkovým spektrálním výkonem a ukazateli, odvozenými od komponenty VLF a LF. Tento vztah se jistě podílel i na významné negativní korelaci mezi věkem a věkově nezávislými ukazateli; paralelní negativní působení nemoci a věku se však projevilo i na významném vztahu mezi věkem a některými věkově již adjustovanými ukazateli.

Na vybraných příkladech třírozměrných grafů jsou demonstrovány problémy, které mohou vzniknout při optickém hodnocení těchto grafů nebo při interpretaci věkově neadjustovaných ukazatelů SA HRV. Závěrem je konstatováno, že při srovnávání SA HRV osob rozdílného věku (zejména u nemocných) je naprosto nezbytné upravit naměřené hodnoty na hodnoty odpovídající příslušnému věku.

*Klíčová slova: spektrální analýza variability srdeční frekvence, metodika hodnocení, věk, diabetes mellitus.*

# THE INFLUENCE OF HOME EXERCISE PROGRAMME ON VENTILATIVE PARAMETERS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

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Submitted in May, 2000

The research was conducted under group of 46 patients with COPD and it was inferred that an appropriate home exercise programme has a profitable influence on inhibition of impairment of ventilative parameters.The assessment involved spirometry and flow-volume tests which were conducted with MasterLab-Transfer, under the auspices of the firm Jaeger. All the patients were examined after 14 and 21 months from the day of leaving the hospital. The outcomes of this research work show that individually physiotherapy at home proceeded by exact physical activity programme causes a reduction in the progression of respiratory dysfunction and makes the illness process stop.

*Keywords: COPD, home exercise programme.*

## INTRODUCTION

One of the basic symptoms of COPD is a deterioration in pulmonary function. A decrease in forced expiratory volume in 1 second ($FEV_1$) along with age is twice as much than in healthy people. Other indicators of ventilative function worsen gradually but the degree of change is difficult to predict and the meaning of it is not known precisely (Burton & Hodgkin, 1984).

The literature underlines the fact that everyday therapeutic exercises are conducive to stopping the progress of illness (Bush & Mc Clements, 1988; Szczegielniak, 1997; Vale, Reardon, & Zu-Wallack, 1993; Wijkstra et al., 1995). The influence of long-lasting therapeutic exercises on a decrease in lung respiratory parameters has not been researched thoroughly.

To this end, the aim of the research is to study the influence of home physiotherapy on pulmonary respiration over a period of one year.

## MATERIALS AND METHODS

46 patients were treated for COPD at a Specialised Hospital in Glucholazy, from March 1994 to September 1997. The selected patients involved 28 men and 18 women. The average age was 55 years (+/– 11), a mean duration of diseases was 10 years (+/– 6). 10 patients were smokers. Non smokers were considered as those who had stopped smoking for at least 10 years.

All patients underwent a 8-week hospital physiotherapy which consisted of respiratory kinesiotherapy and the author's own method of physiotherapy (Szczegielniak, 1997). At the end of the hospital treatment, the patients followed a home exercise programme.

The first examination of all patients was conducted 12–17 (x = 14) months after leaving the hospital. By means of spirometry and flow-volume tests, the following respiratory indicators were taken: forced vital capacity (FVC), forced expiratory volume in 1 second ($FEV_1$), $FEV_1$ as percentage of the vital capacity ($FEV_1$ %), mean maximum expiratory flow ($MMEF_{25-75}$), maximum expiratory flow at 50 % ($MEF_{50}$), and peak expiratory flow (PEF).

Comparative tests were done on all patients before the follow-up admission to the hospital, some 18 to 25 months (x = 21) since the day of the first examination.

The type and the intensity of home training were established individually based on the results of pulmonary function tests using the Jaeger MasterLab-Transfer unit, and the endurance tests using the Jaeger Eos-Sprint unit.

The patients performed home exercise regularly 3 times a week, each exercise lasting 30–40 minutes. The home exercise programme contained:

- postural drainage,
- effective cough,
- practice of slow exhalation into a container filled with water,
- exercises causing a reduced chest muscles tension,

– exercises of the diaphragm and the abdomen muscles,
– exercises improving function of the lower respiratory tract,
– general exercises and cycling on cycle-ergometer at specific speed and over a certain period of time.

The number of repetitions of each exercise, the speed, the sequence and possible changes in exercise were determined for each patient after the end of the hospital physiotherapy and they were verified after 6 months.

## RESULTS AND DISCUSSION

The outcomes of initial and final research studies were subjected to a comparative analysis (TABLE 1). An analysis of the results was conducted by estimation of the averages of individual parameters, before and after therapeutic exercises. The parameter differences were compared on the level of significance $p < 0.05$. All the differences were statistically insignificant.

**TABLE 1**
The ventilatory parameters mean values

| Parameter | I Examination values | II Examination values | Differences | Statistical Significance | Predicted values (%) | |
|---|---|---|---|---|---|---|
| | | | | | Examination I | Examination II |
| FVC (litre) | | | | | | |
| x | 2.942 | 2.880 | 0.062 | NS | 86.127 | 83.877 |
| s | +/-0.88 | +/-0.91 | 2% | | | |
| min | 1.81 | 1.80 | | | | |
| max | 4.45 | 4.40 | | | | |
| $FEV_1$ (litre) | | | | | | |
| x | 2.047 | 1.999 | 0.048 | NS | 73.969 | 69.310 |
| s | +/-0.79 | +/-0.88 | 2% | | | |
| min | 1.36 | 1.36 | | | | |
| max | 3.50 | 3.40 | | | | |
| $FEV_1$% | | | | | | |
| x | 71.555 | 69.097 | 2.458 | NS | 91.653 | 88.750 |
| s | +/-14.4 | +/-13.7 | | | | |
| min | 41.7 | 41.0 | | | | |
| max | 98.9 | 97.2 | | | | |
| $MMEF_{25-75}$ (litre/sec.) | | | | | | |
| x | 1.818 | 1.767 | 0.051 | NS | 53.693 | 50.011 |
| s | +/-1.25 | +/-1.35 | 3% | | | |
| min | 0.53 | 0.51 | | | | |
| max | 4.00 | 3.58 | | | | |
| $MEF_{50}$ (litre/sec.) | | | | | | |
| x | 2.173 | 2.101 | 0.072 | NS | 51.133 | 49.272 |
| s | +/-1.61 | +/-2.82 | 3% | | | |
| min | 0.56 | 0.55 | | | | |
| max | 5.52 | 5.69 | | | | |
| PEF (litre/sec.) | | | | | | |
| x | 4.191 | 4.053 | 0.138 | NS | 55.105 | 51.749 |
| s | +/-2.14 | +/-2.40 | 3% | | | |
| min | 1.69 | 1.61 | | | | |
| max | 8.76 | 7.87 | | | | |

The final tests produced reduction in the following indicators: FVC by 62 ml (2 %), $FEV_1$ % by 2 %, $MMEF_{25–75}$ by 51 ml (3 %), $MEF_{50}$ by 72 ml (3 %), and PEF by 138 ml (3 %). The research it also proved that the parameter $FEV_1$ reduced by 49 ml (2 %). In the literature it is said the reduction of this indicator is 2 or 3 times higher in people suffering from COPD during the whole year (Burton & Hodgkin, 1994).

The stated reduction of averages of individual parameters shows that the disturbance in respiratory function is progressive over checked patients in the period of 2 years after cessation of hospital physiotherapy.

This research work shows that an appropriate long-term home exercise programme contributes to a reduction in the progression of respiratory dysfunction. Some authors have shown the possibility of improvement in respiratory function with physiotherapy of short duration only (Cox, Hendrix, Binkhorst, & Van Hervaarden, 1993; Ketelaars, Abu-Saad, Schlösser, Mostert, & Wouters, 1997).

Helping patients to overcome difficulties with home physiotherapy and dealing with their prejudice against exercises as well as teaching an appropriate execution of the exercises are of great importance.

As COPD progresses a patient's physical ability worsens making them unfit for work. This disease contributes to shortening of the life span and creates an important social and economic problem (Burton & Hodgkin, 1984; Szczegielniak, 1997).

Taking into consideration the importance of physical exercises in the treatment of chronic obstructive pulmonary disease, it must be emphasized that physiotherapy plays an important role not only hospital stay but also at home.

A long-term programme of physical treatment can prevent patients from complication and reduce frequency of hospital stay.

## CONCLUSION

1. The showed reduction in lung respiratory dysfunction speaks for a long-term therapeutic influence in the form of everyday exercises performed at home in patients suffering from COPD.
2. The results of the research show that home exercise programme should be a continuation of the hospital physiotherapy in order to reduce the progress of respiratory dysfunction in COPD patients.

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**VLIV DOMÁCÍHO CVIČEBNÍHO PROGRAMU NA VENTILAČNÍ PARAMETRY U PACIENTŮ S CHRONICKOU OBSTRUKČNÍ PLICNÍ NEMOCÍ (COPD)**
(Souhrn anglického textu)

Výzkum byl prováděn na skupině 46-ti pacientů s COPD a bylo dokázáno, že vhodný domácí cvičební program má blahodárný vliv – zabraňuje zhoršení ventilačních parametrů. Hodnocení bylo založeno na testech plné funkčnosti plic, které byly provedeny pomocí přístroje MasterLab-Transfer pod patronací firmy Jaeger. Všichni pacienti byli zkoumáni po 14 a 21 měsících od ukončení pobytu v nemocnici. Výsledky tohoto výzkumu ukazují, že individuální fyzioterapie prováděná doma podle přesného programu pohybové aktivity způsobuje redukci rozvoje respirační dysfunkce a zastavuje postup onemocnění.

*Klíčová slova: COPD, domácí cvičební program.*

# CHANGES IN EEG AND LATERAL PREFERENCE IN BOYS AND GIRLS AGED 12–14

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Research on the structure of the brain (for example planum temporale, corpus callosum, sulcus centralis) and its functions has demonstrated a relationship in terms of manual, visual and limb dominance. The development of lateral preference in the ontogenetical process correlates significantly with the rate of development of the nervous system where maturity can be indirectly evaluated by the bioelectrical activity of the brain (EEG). The main goal of this paper was to compare lateral preference process of subjects with normal and abnormal EEG. This research project included 108 elementary school children aged 12–14. The EEG was registered at rest and after particular activities. Hand, foot and eye preferences were evaluated through the Zazzo test and the voluntary motions of the facial muscle were chosen from the Kwinta test. Balance was evaluated by the flamingo balance test. Slight and moderately abnormal EEG occurred in 10.8 % of the tested subjects and severely abnormal EEG in 3.8 % of the researched population. In these two groups, ambidexterity occurred more often than in subjects with normal EEG (50 % females with hidden left hand dominance according to Arenda test). The same phenomenon appeared in relation to the lower limbs. Subjects with abnormal EEG showed lower values in the perception of balance in comparison with subjects with normal EEG.

*Keywords: EEG, lateralisation, balance, child.*

## INTRODUCTION

Lateral preference is an ontogenetical process, which correlates with the body structure and the activity of the nervous system. The applied methods of histological, magnetic resonance (MR) and receptor autoradiographic techniques indicated, in subjects with different lateralisation, asymmetry in the temporal lobe (PT) and the forebrain in relation to the density of myelinated fibres and transmitter receptor densities in sensorimotor regions of the cortex. The regions of the cortex relate to the dominant hand, region 4 of Brodmann among them, is characterised by a different rate of maturation (Waber, 1976; Schlaug et al., 1995; Amunts et al., 1996; Steinmetz, 1996; Zilles et al., 1996). One of the methods of evaluation of the nervous system maturity is the analysis of brain's bioelectrical activity. The EEG norms are related to the age of the tested subjects and their state of consciousness (vigilance and sleep).

From the research conducted by Lenneberg (1973) and Waber (1976) one can conclude that the period of maturation is the decisive moment in the development of lateral preference. A question arises: do subjects with abnormal EEG represent a unilateral preference in relation to the hand, leg, eye and face or do they show different forms of above mentioned body parts domination?

Some research evidences significant influence of the maturity of the nervous system on the level of coordinational abilities in children and youth (Żak, 1991; Szopa, 1996; Jahanshahi et al., 1997). Maintaining balance of the body is a complex ability dependent on the integration of stimuli from the different receptors and the central nervous system. Balancing on one leg may be used simultaneously as a test for determining the dominant limb and for the evaluation of coordinated predispositions (Lumaye, 1983).

The main goal of this research project was to compare lateral preference of subjects with normal and abnormal EEG. Additionaly an attempt to evaluate body balance in relation to the EEG was made.

## MATERIAL AND METHODS

The research was conducted on 108 pupils from elementary schools in Katowice ranging from 12–14 years. None of the examined children were treated for the disorders of the nervous system or subjected to EEG examination. These age groups were selected because of the onset of puberty, during which changes in lateral preference occur. The main objective of the research project included EEG examination, determination of lateral preference of both upper and lower limbs, eyes, face and evaluation of body balance.

Lateral preference was evaluated by the following tests (Zazzo et al., 1974):
- hands – grasping an object, manual task with cards, drawing lines, hand dynamometry,
- legs – kicking the ball to a target, one leg standing, target jumping, step climbing,
- eyes – sighting, targeting,
- facial muscles – 8 tasks chosen from the Kwinta test.

The results of the test depending on the dominant side were registered as R (right), L (left) and A (ambidextrous). Lateral preference considering the dominant hand and leg was described as homolateral: RR – right-sided with the dominance of right hand and leg, LL – left-sided, crossed in case of a RL or LR model and undetermined in case of lack of limb dominance (RA, LA, AL).

To evaluate the manual dominance the Arenda (1950) test was also applied which is based on drawing the face profile. The face profile drawn with the right hand and turned leftwards indicates right-handedness while the right turn of the profile indicates "hidden left-handedness".

The EEG was registered at the Laboratory of City Neurological Clinic. The Medicor 16-S was used in this project. The electrode placement was according to the international 10–20 system using a bipolar recording (Tyner et al., 1983). The EEG was registered at rest and under routine activation such as hyperventilation and opening and closing of the eyes (blocking of the alfa rhythm).

"The records were classified by means of conventional visual inspection and divided into 4 classes:
- normal;
- slightly abnormal records contained a small quantity of episodic or diffuse 4–7 Hz activity with an amplitude not exceeding 100 mV;
- moderately abnormal EEG contained a greater quantity of 4–7 Hz activity and/or some diffuse delta activity;
- "severely abnormal EEGs were dominated by delta and theta activity" (Johannesson & Gudmundsson, 1988, 68).

The description and interpretation was performed by neurologists.

The balancing test was performed according to "the eurofit" battery test modified by Żak (1991). The results obtained in seconds were adjusted to points according to norms, which consider age and sex. The differences between mean values were analyzed using Student's t-test in groups with normal and abnormal EEG ($p < .05$).

## RESULTS

The extent of abnormal EEG was similar in boys and girls 13.6 % and 15.7 % respectively (TABLE 1). In severely abnormal EEGs (n = 4), besides the changes determined by Johannesson (1988), spike-and-waves complexes occured.

**TABLE 1**
The distribution of subjects based on the analysis of EEG

| Subjects | EEG | | | | | |
|---|---|---|---|---|---|---|
| | Normal | | Abnormal | | | |
| | | | slightly and moderately | | severely | |
| | n | % | n | % | n | % |
| Girls | 54 | 84,3 | 8 | 12,5 | 2 | 3,2 |
| Boys | 38 | 86,4 | 4 | 9,1 | 2 | 4,5 |

Lateral preference of the limbs and eyes are presented in Fig. 1. The differences in the dominance of the lower and upper limbs among the tested subjects were most often related to ambidexterity in cases of children with abnormal EEG.

Fig. 2 presents results of Arenda test based on the drawing of the face profile. "Hidden left-handedness" was characteristic in 50 % of girls with abnormal EEG. In subjects with normal EEG no sexual differences were registered in the frequency of "hidden left-handedness" occurrence.

Lateral preference of the facial muscles is presented in Fig. 3. In each group most of the subjects began the test on the right side, yet in relation to the proper performance of the movements slightly better results on the left side were obtained in boys. The most difficult task of the Kwinta test included one eye blinking. According to Stambak (Zazzo et al., 1974) this task should be unilaterally performed by children between the ages of 8–12. In the group of subjects with abnormal EEG the task was performed properly in 50 % of the boys and 40 % of the girls, while in the group of the subjects with normal EEG 63 % and 55 % respectively.

Undetermined lateral preference in case of upper limb-lower limb complex (RA, LA, AR, AL) occurred more frequently in groups with abnormal EEG (24.4 % in girls, 15.8 % in boys, Fig. 4).

The subjects with abnormal EEG registered worse results in the balancing test in comparison to the group with normal EEG (TABLE 2). Girls obtained better results in the balancing test in both groups.

**TABLE 2**
Subject distribution based on the balance criteris (points)

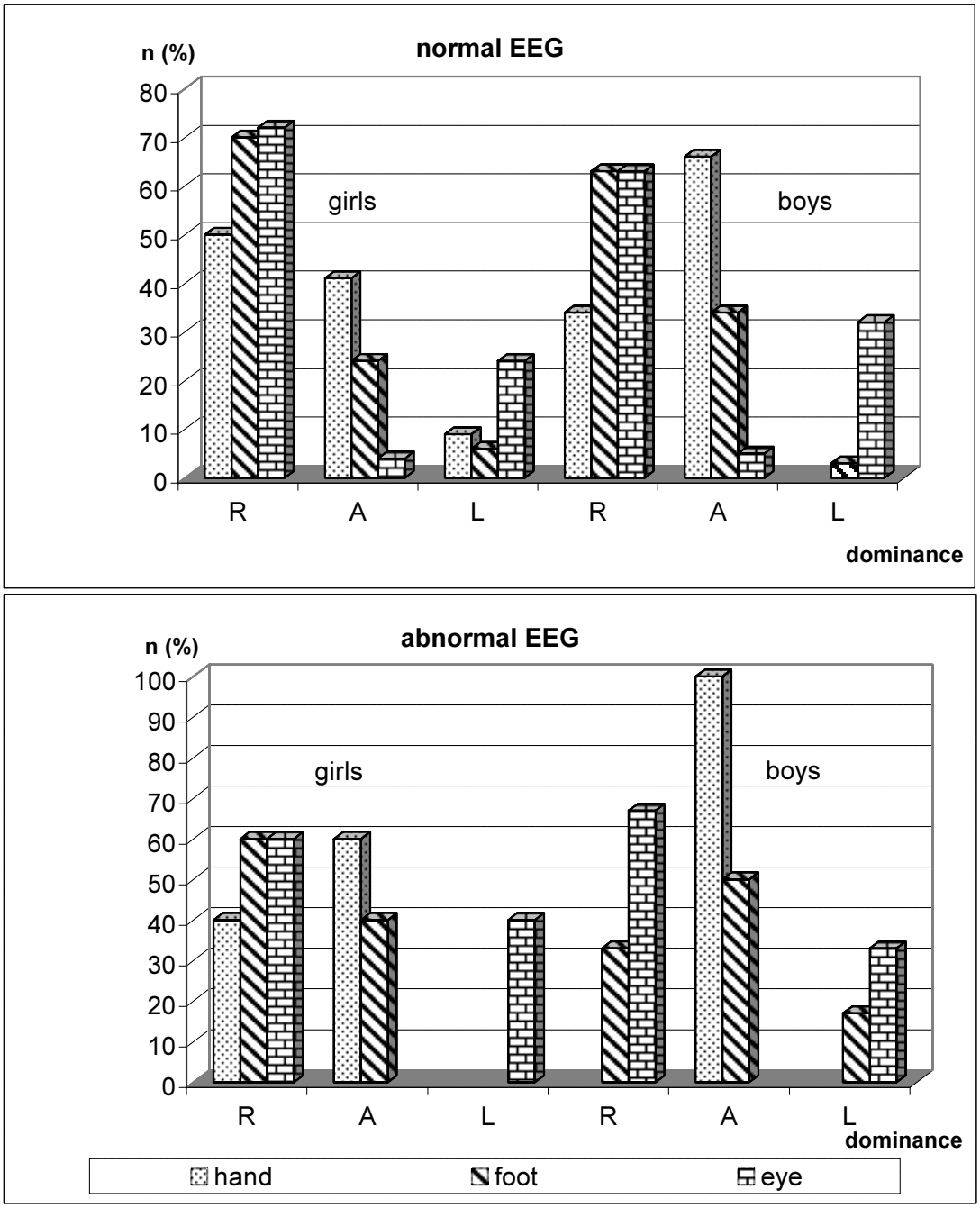
| Subjects | EEG | | | | d | t - test |
|---|---|---|---|---|---|---|
| | Normal | | Abnormal | | | |
| | n | x ± SD | n | x ± SD | | |
| Girls | 54 | 39,4 ± 11,9 | 10 | 34,1 ± 11,3 | 5,3 | 1,29 |
| Boys | 38 | 32,7 ± 22,1 | 6 | 23,3 ± 11,9 | 9,4 | 1,09 |

## DISCUSSION

Among the waves and rhythms in the normal EEG, the most often analysed is the alfa rhythm registered

in the occipital and vertex outputs. This rhythm changes asymmetrically under the influence of smoking tobacco, listening to music of different affective content, as well as manual activities with an evoked potential (Steinmetz, 1992; Persinger & Richards, 1994; Hori et al., 1996; Iwaki et al., 1997). These changes are presented in Fig. 5. Minor change was noted in the EEG concerning basic dysfunction i.e. the alpha rhythm and manifested itself in the presence of theta waves, particularly in the occipital leads, as well as in the dominance of beta waves overlapping the basic function. The group with abnormal EEG was detected in 8 subjects while heterogeneous lateral preference and difficulties in bilateral performance of facial muscles movements occurred in 7 of them. According to some authors (Davidson & Schwartz, 1976; Waber, 1976; Bogdanowicz, 1996) a minimal brain dysfunction may be one of the causes of undetermined lateral preference, which was later confirmed.

**Fig 1**
Limb and eye domination of tested subjects



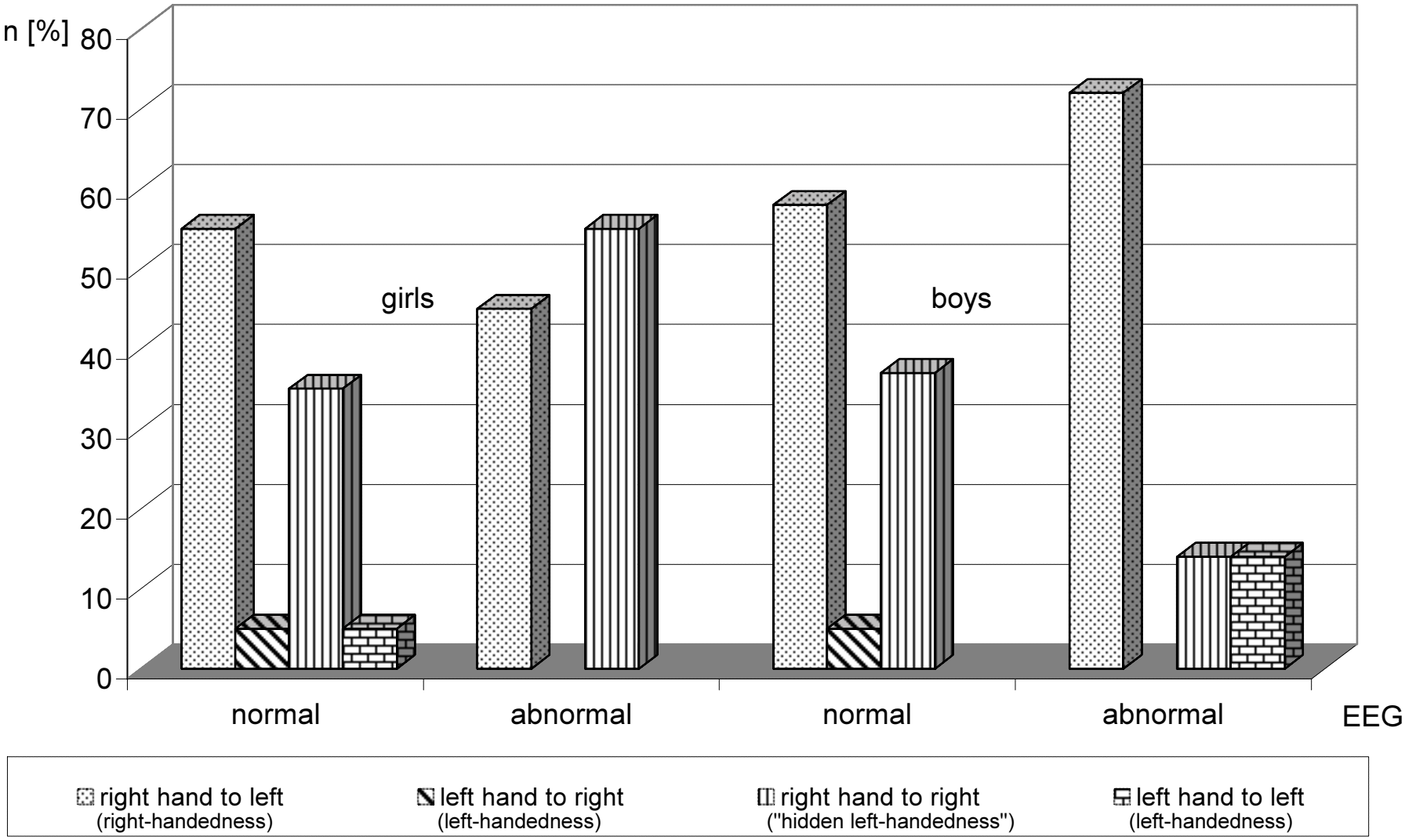



**Fig. 2**
The profile of the obtained results

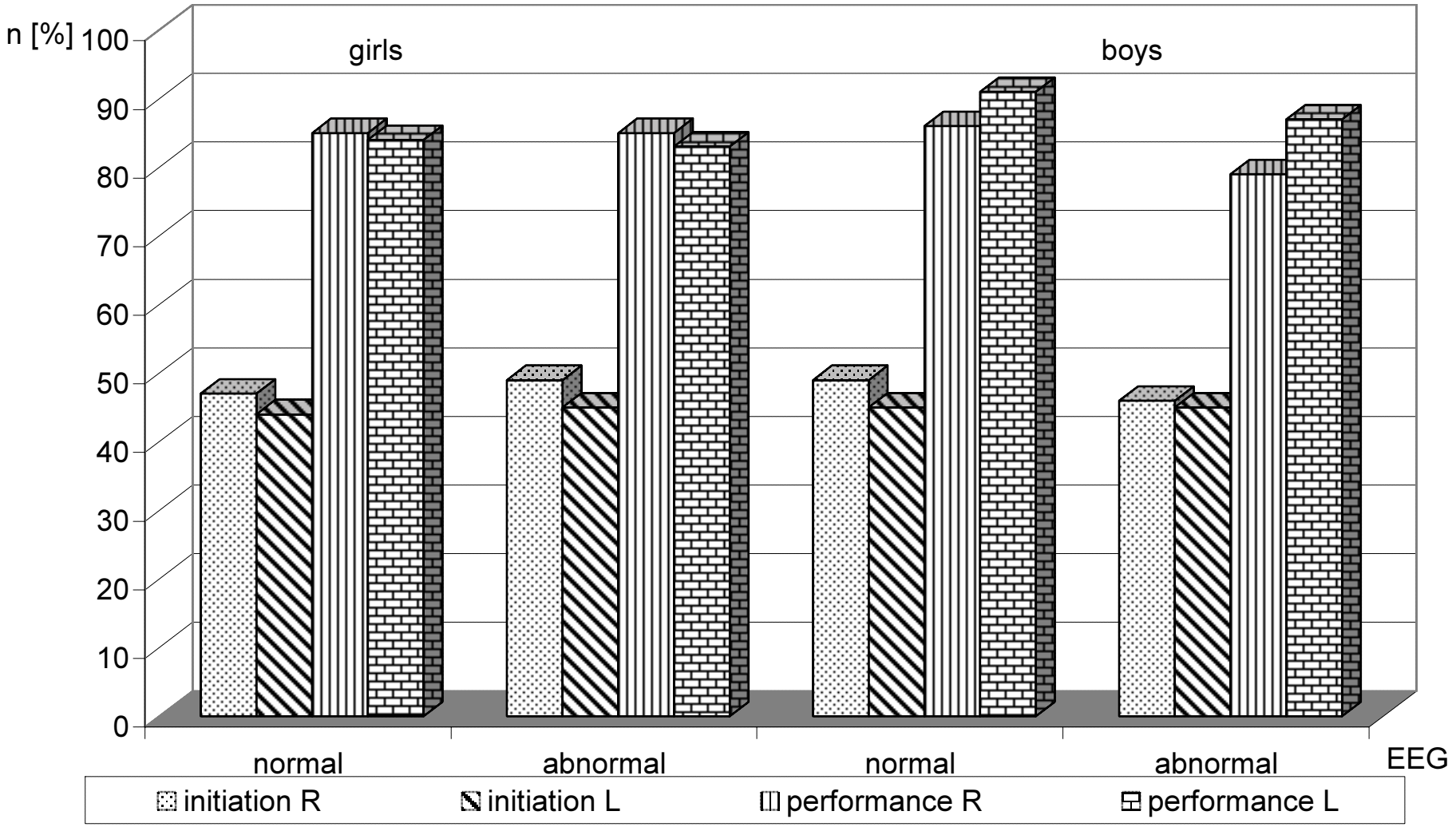



**Fig. 3**
Face lateralization of the tested subjects

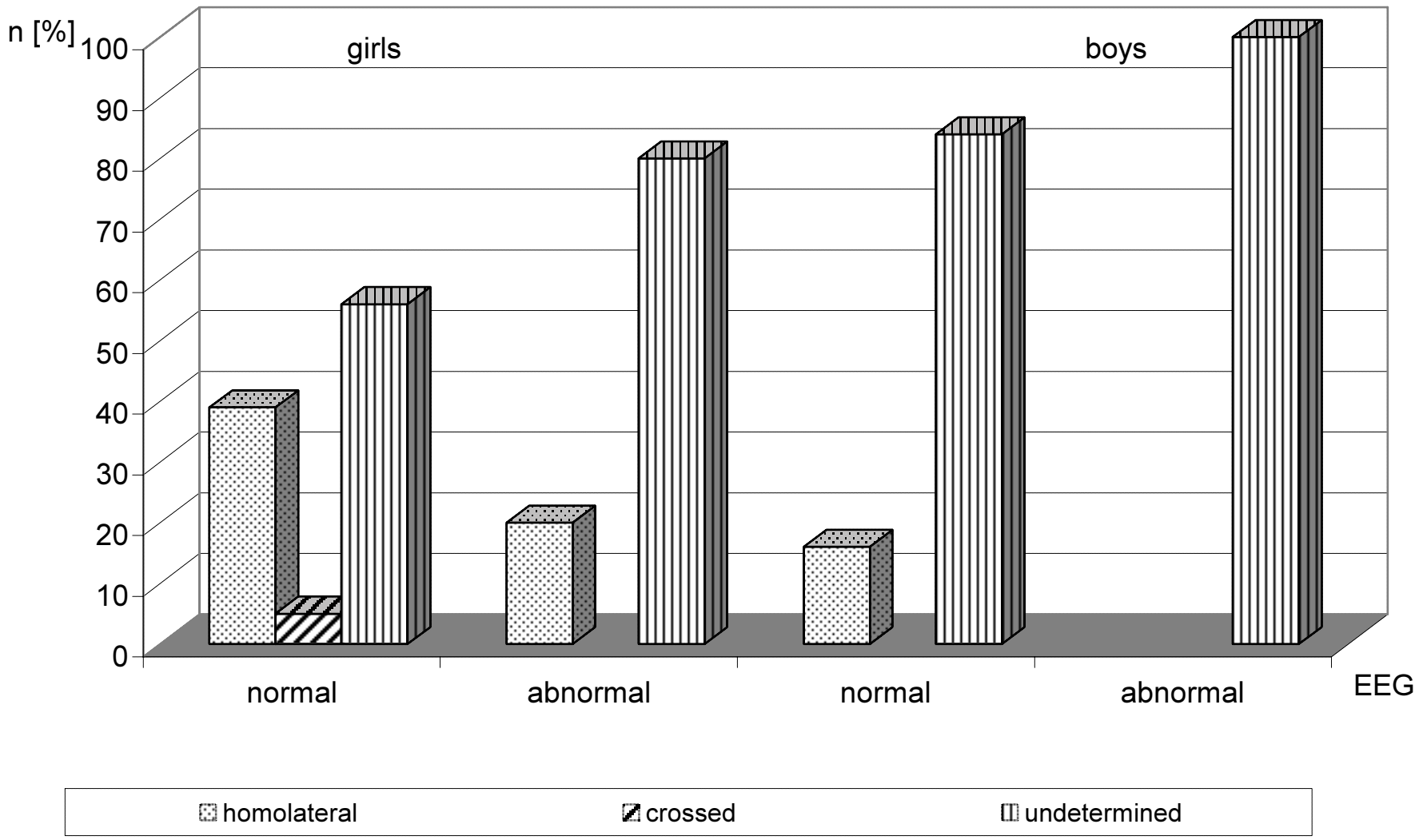
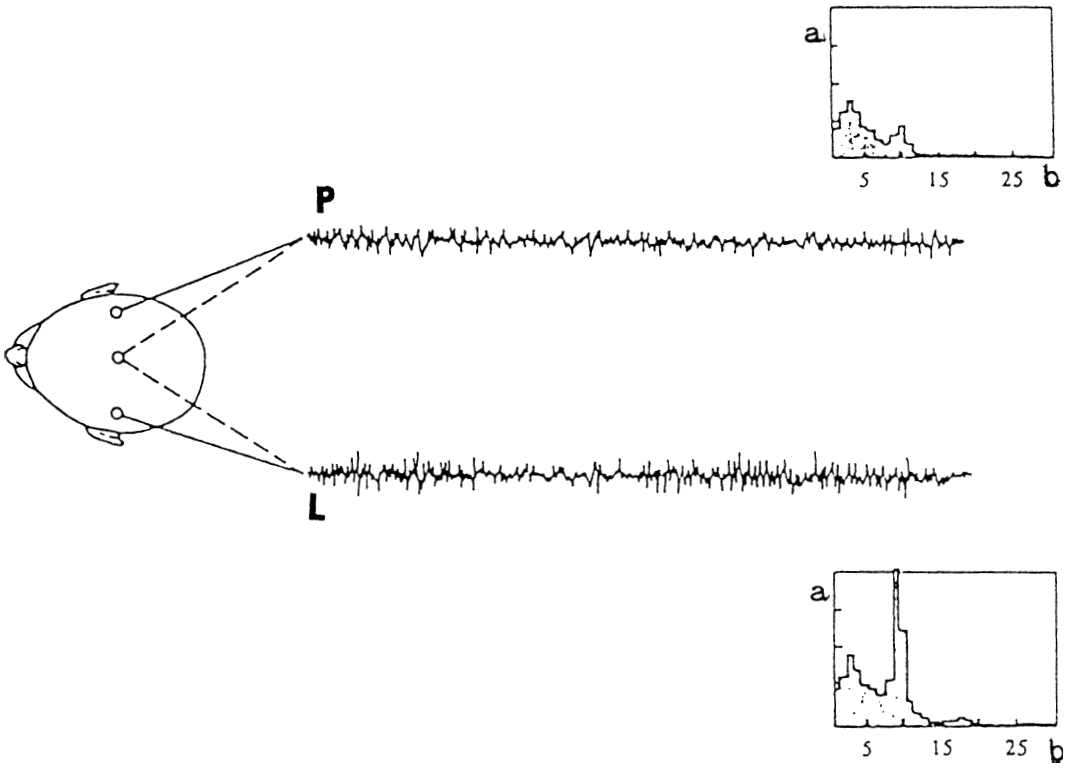



**Fig. 4**
Lateral preference based on the hand leg domination

**Fig. 5**
The rhythm of alfa waves in EEG during a manual test performed according GALINA and ORNSTEIN (1972); a – relative frequency, b – frequency in Hz




Ambidexterity occurs more often in boys (Karajew, 1985; Stokłosa, 1992; Malinowski & Przybyła, 1993) and was confirmed by this research especially in group with the disturbed EEG. Viatleva (1991) indicated that ambidexterous children aged 6–7 are characterised by a higher reactivity of the theta waves in relation to strong stimuli, in comparison to the left-handed children of the same age. In own researches the existence of theta waves during hyperventilation was registered in four cases, especially in occipital outputs. These assumptions were characteristic of ambidexterous subjects.

Similar results of visual dominance occurred in both groups with normal and abnormal EEG. This indicates the lack of influence of brain disturbances on the visual dominance. The research performed according to the Wada test indicates that the dominance of the left hemisphere of the brain is not related to visual dominance, while Geffen et al. (1971) stated that the type of stimuli (verbal or non-verbal) decide the preference for a particular eye. On the basis of these statements Hiscock and Kinsbourne (Bogdanowicz, 1989) expressed doubt related to the sense of the visual dominance evaluation through the determinantion of lateral preference. The obtained results confirmed these doubts.

This research did not detect any sexual differences in the frequency of the occurrence of "hidden left-handedness" which is in accordance with the results presented by Wokroj (1986). The obtained results, 35.3–36.8 %, are higher than those obtained by Wokroj: 26.1 % in pre-school children, 17.6 % in elementary school children and 21.6 % in boys and 14.3 % in girls aged 15–16 (Malinowski & Przybyła, 1993). The traditional view that right-handedness in preferred in manual activities, whereas left-handedness is disapproved of applies to the relationship between physical fitness and functional asymmetry and may be justified, if right-sidedness involves also other twin organs, and results from clear-cut predominance of the left cerebral hemisphere (Subirana, 1964).

The dysfunctions of the central nervous system may be the cause of specific learning disabilities, which is reflected by the latest definitions of this term included in International Classification of Diseases (ICD-10) and Diagnostic and Statistic Manual of Mental Disorder (DSM-IV) (Bogdanowicz, 1996). These specific difficulties relate to different movement skills. They may include motor skill disorders, which are exemplified by the developmental disorders of coordination: improper movement sequences, time and space movement disorders.

Body balance evaluated by the flamingo balance test indicates its strong relationship with movement coordination. The research performed on children and youth (Żak, 1991) indicated that the body balance reaches the highest values in both sexes at the age of 14 yet it is higher in case of girls until the age of 12. This research conducted on the group aged 12–14 indicated higher results of balance in the case of girls with a higher sexual difference, in subjects with abnormal EEG.

The evaluation of body balance, manual and leg preference was performed by Lumaye (1983). The author stated that there were no significant differences in the direction of loosing balance in relation to lateral preference. For instance girls with one side dominance 46.7 % fall to the right side and in the case of the cross lateralisation 48.6 %. It may be assumed that the cause of worse results in body balance is related to the disturbances in background activity.

The phenomenon of EEG relationship with lateral preference requires further research on groups with the greater age span and higher number of subjects, because most of the currently presented hypotheses and theories are very much controversial, especially in the case of dymorphical differences. According to Waber (1976) significant differences in lateral preference of boys and girls occurred during the maturation and are manifested in reactions to verbal stimuli and in spatial coordination of movement. On the other hand research conducted by Davidson (1976) on females and males, to relate the rate of movement adjustment to the symmetry of alfa wave registration in the EEG, did not indicate any sexual differences.

## CONCLUSIONS

1. Ambidexterity occurs more often in subjects with abnormal EEG.
2. The frequency of occurrence of eye domination (R, L, A) is similar in subjects with normal and abnormal EEG.
3. Subjects with abnormal EEG fair worse in the balancing test.

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**ZMĚNY ZÁZNAMU EEG A LATERÁLNÍ PREFERENCE DĚVČAT A CHLAPCŮ VE VĚKU 12 AŽ 14 LET**

(Souhrn anglického textu)

Vyšetření činností mozkových struktur (např. planum temporale, corpus callosum, sulcus centralis) ukázalo jejich souvislost s lateralitou oka, ruky a nohy. Formování laterality v lidské ontogenezi koreluje s rychlostí vývoje nervové soustavy, jejíž zralost lze posoudit nepřímo mj. pomocí vyšetření bioelektrické činnosti mozku (EEG). Cílem výzkumu bylo porovnání laterální preference jedinců s normálními a abnormálními záznamy EEG. Výzkumu se zúčastnilo 108 žáků ve věku 12 až 14 let (hochů a dívek). Záznam EEG byl proveden v klidové poloze a po standardní aplikaci. Lateralita byla určena pomocí zkoušky dle Zazza, pro odhad dominance ruky, nohy, oka, a také zkoušky vybrané z testu podle Kwinta (pohyblivost mimických svalů obličeje). Pomocí testu „flamingo balance" byla rovněž měřena rovnováha. Drobné a středně výrazné abnormality EEG záznamu se vyskytovaly u 10,8 % probandů, zřetelná abnormalita u 3,8 % žáků. V této skupině jedinců se častěji projevovala ambidextrie (50 % devčat s „latentní levorukostí" dle testu podle Arenda) a obounohost, v komparaci se skupinou s normálním záznamem EEG. U probandů s abnormálním záznamem EEG byl charakteristický horší pocit rovnováhy ve srovnání s normálním EEG.

*Klíčová slova: EEG, lateralita, rovnováha, děti.*

# INSTRUCTIONS FOR MANUSCRIPT FOR THE ACTA UPO GYMNICA

The Acta Universitatis Palackianae Olomucensis magazine 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 Gymnica Editorial Board is looking forward to all manuscripts written on the above subject.

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The text of the contribution must be 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 disk and also as a printout.

All contributions are reviewed anonymously.

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Title of the contribution, names of its authors, workplace, date of submission of contribution, summary of the text in English, key words.

**Text of the contribution**

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**Epilogue of the contribution**

A reference summary, address of the main contributing author, summary including the key words.

**Tables, pictures, graphs, appendices**

To be written on separate pages. A table is to be marked as TABLE 1 with its name below, write on the left margin above the table (the same applies for appendices). A picture is to be marked as Fig. 1, write from the left above the picture (the same applies for a graph).

We look forward to our further cooperation.

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ACTA
UNIVERSITATIS PALACKIANAE OLOMUCENSIS

**GYMNICA Vol. 30 No. 1**

Published by Palacký University, Olomouc 2000



Printed by Polygrafické středisko VUP

**ISBN 80-244-0115-0**
**ISSN 1212-1185**