Research tools to develop identification and measurement of stress factors in two groups of athletic population

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***Abstract*—**The article presents the results of the research focused on stress factors followed in two groups – top-level athletes and recreational sportsmen. With regard to the methods used in the research the answers obtained in subjective questioning were statistically processed and then the respondents were classified into the zones of stress potential. In the field of frustration tolerance half of the top-level sportsmen group have low to average value of stress factors. The situation is similar in the recreational sportsmen group where 50% of them also show low to average value of stress factors. As far as coping with stress is concerned it has been revealed that about two thirds of the surveyed top-level athletes. In terms of handling stress it has been found out that 68% of people from the top-level athletes group fall into the third stress zone and in the common population group 72% of its members again fall into the healthiest third zone. The electronic online application which enabled subjective questioning and classification into stress factors was set up and placed on the web.

***Keywords*—**Anti-stress effects of sport, quality of life, frustration tolerance, handling stress, psychosomatic symptoms.

I. Introduction

An important element in reducing stress factors is physical fitness. People who regularly do *aerobic exercises*, that is any kind of endurance activity which increases heart rate and oxygen consumption – e.g. running, swimming, cycling or cross-country skiing – have significantly lower heart rate and blood pressure in a stress situation than other untrained people.

Physically fit individuals tend to fall ill as a result of stress events less often than people who are not in a good condition. In relation to these facts the programmes for coping with increased stress load are currently focused on *physical fitness*. The study on patients suffering from chronic chest pain has revealed that the combination of stress management techniques and regular exercise resulted in less frequent occurrence of angina pectoris than the actual stress management training (see Fig. 1). [1], [2]

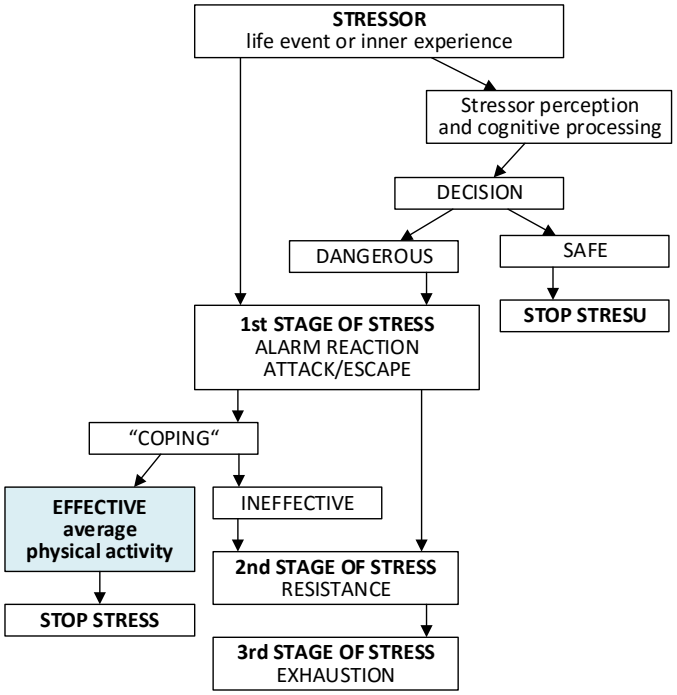

Fig. 1. Stage of stress (adjusted according to [2])

A. Development of sport psychology

The area of *sport psychology* is based on ideas about the correlation between the physical and mental dimension of the human. In this sense a thousand-year-old tradition of ancient systems – Indian yoga, Chinese kung-fu or Japanese morito – has been preserved till nowadays. [3]

In Europe there is a significant Greek Hellenic tradition of *kalokagathia – kalos kai agathos*, i.e. beautiful and good. It emphasizes the harmony of physical and mental qualities. A Greek satirist Iuvenalis became famous for his well-known statement "*Optandum est ut sit mens sana in corpore sano*" – It is desirable for the sound mind to be in the sound body.

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In the ancient times the interaction of physical and mental was understood better than in the following Middle Ages. Christianity elevated the spiritual area – represented by belief in god – above everything else. The physical matters became inferior or even despicable for their association with "low" and also sinful needs. We can understand this change well by comparison of gothic statues with the ancient ones.

Later Classicism and the Renaissance renewed the significance of ancient harmonious ideals, however Cartesian philosophy emphasizing the sovereignty of "*res cogitans*" (René Descartes – *Cogito ergo sum – I think therefore I am)* still causes underestimating human corporeality, physical education and physical culture. On the other hand, this dualism leads to a complete underestimation of psyche in physical performances – performances are so misunderstood only as the biological result of muscle activity.

In order to commence the scientific history of sport psychology, first of all psychology itself had to be constituted as a scientific (experimental) branch. This happened in the second half of the 19th century. Furthermore, sport had to acquire its modern form, which took place at about the same time. This was the condition of the existence of a scientific method and a distinctive object of research. Then only the motivation of professionals – psychologists or educators and athletes – was needed. Thus in the scientific literature of the late 19th and early 20th centuries we can find articles concerning, for example psychology of Turner gymnastics, American football, golf or cycling. Applied research strategies are descriptive, the main method is participant observation and subsequent interpretations are considered on the basis of psychological principles. Some papers have educative form, e.g. "*Essays on psychology of sport*" by Pierre de Coubertain from 1913. We can say that the period until the First World War represents the phase of the first accidental non-systematic research in sport psychology. [4]

After the First World War the situation is different. First universities with sport and physical education orientation come into existence. They employ experts whose job is a systematic research in psychology of sport. First *laboratories of sport psychology* are established in Leipzig, Moscow, Leningrad and in Illinois. First experimental works deal with the description of sensomotor performances, progress of sensomotor learning, the role of exercise in mental hygiene of children, description of athletes' personalities in terms of their ability to deploy will. Textbook-type systematic works are also created. Worldwide it is a founding phase of sport psychology, connected from the beginning with *university sport environment*. [4]

After the Second World War a big boom of *olympic sports* begins. Closed attention worldwide is given to the preparation of top athletes including psychological preparation. This also provokes a research interest in psychological issues of limit and above-limit performance. Increasingly psychologists all over the world are involved in psychological care for top athletes. Essentially there is an interest in solving technical issues of the influence of psyche on sport performance and the interest in professional consultations among sport psychologists internationally. In 1965 the first world congress of sport psychology is held in Rome. It is a professional forum where ISSP (*International Society of Sport Psychology*) is founded. ISSP is a basis of international professional meetings, it holds conferences, organizes projects, helps to issue publications. Thus it stimulates professional activity of national organizations of sport psychology.

With a relatively small time lag continental organizations of sport psychology come into existence. FEPSAC (abbr. of French title of *Fédération Européene de Psychologie des Sports et des Activités Corporelles*) - the first of them - is founded in Varna in 1968. This marks the entry into the phase of internationalization of sport psychology in the second half of the 20th century. In most countries this is preceded by establishing national organizations of sport psychology as interest groups. They associate professionals interested in the sports area of applied psychology in individual states. [5], [6]

After the end of politically motivated rivalry in the last decade of the last century we can see a new orientation of professional interests primarily towards the issues of *experience in sport* and issues of *quality of life improvement through sports activities*. A new term *well-being* is introduced and the *relation between physical activities and mental health* for wider public is addressed. [7], [8]

B. Modern psychological typology of sports

There are traditional criteria for classification of sports according to time, environment, number of people and organizational character (winter, summer, indoor, outdoor, water, aviation, motor, individual, team, swimming, ball, bat, riding, olympic, shooting, combat, etc.). Individual groups overlap and mingle.

Recently we often speak about adrenaline sports that have the experience of fear in common (expected danger) which manifests itself by secretion of *adrenalin hormone* from adrenal glands into the blood stream with mobilization effects on human organism. Thus a psychological criterion is introduced in the classification of sports. The following part provides an overview of sports activities according to the similarity of their psychological demands, i.e. according to psychological criteria – sensomotor sports, functionally-mobilizing, anticipatory, technical or risky. [9], [6], [10]

Sensomotor sports have high demands on coordination of movements in connection with fast and accurate perception of conditions of the sports activity. Two subgroups can be mentioned here. They are sports requiring subtle coordination of "eye – hand" type. Primarily shooting sports are included here. They are focused on precise aiming and triggering (centering) in relation to the target. Aesthetic-coordination sports with the demands on gracefully performed movements, where artistic impression of performance is assessed, constitute the other subgroup (gymnastics, figure skating, swimming, diving, ski jumping, long jump, as well as acrobatic and dance sports, artistic cycling and freestyle).

Function-mobilizing sports demand mobilization of the athlete's energetic functions. This mobilization can be of a short-term, one-time character involving concentrated boost of energy in a point manner. The following sports can be

included here – athletic jumps, throws, tosses or weightlifting snatches and jerks and any other one-time power attempts. The mobilization can also have a long-term character – this is typical for endurance sports where the question of will is psychologically predominant and together with energetic coverage it determines endurance of the athlete (long runs, walking, road cycling, long-distance swimming, rowing, canoeing, multi-event endurance competitions, etc.).

Anticipatory sports, sometimes also called heuristic, are sports whose psychological basis is the anticipation of subsequent actions and the creative solution of occurring problem tasks (heuristic). It is the activity of one person in individual decision processes (e.g. in tennis, boxing, wrestling, karate – where it is necessary to anticipate the rival's activity and react tactically and creatively) or psychologically different group activity where the team cooperation is needed usually in reaction to the rival's activity (collective games which predominantly require player's intelligence). This group is represented by a vast and extraordinarily popular area of sport games, psychologically interesting mainly for their group dynamics and game creativity. Collective sport games as psychological type of sports activity dominate in sports. With their extent and significance they surpass all other sports activities. They are popular mainly as an object of spectators' interest and a matter of club identification. Naturally psychological demands of sports can be combined, for example heuristic and endurance in orienteering or aesthetic sensomotor and concentration on take-off in ski jumping.

Technical or risky sports – here the standard of controlled technical equipment is projected into the performance. All "petrol" sports belong to this group as well as yachting, sailing, parachuting, down-hill (skis, snowboards, bobsleighs, bicycles, boats and other). It is the vast range of sports often overlapping with adrenaline sports.

Like any typology also this one is only approximate. Some sports with their psychological demands belong to more groups and some of them are difficult to be classified. Modern golf, for example, is the matter of sensomotor centring coordination but also stroke functional mobilization. To make it complete it might be good to include the category of sports cooperating with animals (riding, dog sleigh competitions). Also psychologically specific sports where achieving and pervading are important cannot be easily classified. These are mountaineering, climbing, speleology, diving, speleology diving, canyoning, etc.

It cannot be ignored that some sports generate a distinctive sport sub-culture shown in speech, clothing, value orientation and the subsequent lifestyle. Thus in sport sociology we speak for example about the sub-culture of "sliding sports" (surfing, skateboarding, snowboarding, etc.) where feelings of "being free, cool and in" are important, i.e. to be free in calmly doing exciting things and let oneself absorbed by the activity, "to be in it" (experiences of ecstatic immersion and a "flow-type" passion). Similarly there are for example sub-cultures of motor sports. Apparently sports nowadays tend to resort to model, simulated conditions (rowing, spinning, ergometers of all kinds, climbing, golf and shooting simulators, flight simulators, water slalom in an artificial canal). With the expansion of sports and upgrading the virtual environment this tendency will be increasingly productive.

Our research dealing with the groups of top and recreational athletes in cross-country skiing relates to three types of sport events – *sensomotor, function-mobilizing and anticipatory*.

C. Current methods of inquiring in sport psychology

Psychology of sport tries to explain the relation between sport and psyche. Thus it belongs to analytical, explorative and interpreting sciences. Its methods are mainly inquiring as it is in all other psychological disciplines. On the other hand there is a great demand for methods of sport psychology usable in affecting individuals or groups to improve their sports activity. There is a large variety of formative, regulatory methods, those derived from psychotherapy which mingle with pedagogy *(so called psychology)*, psychohygiene, instructional and training methods. Neither inquiring nor formative methods of sport psychology are strictly specialized only in the field of sport psychology. Some of them originate in extra-sport areas of psychology, just a small part of them was created and standardized specially in the conditions of sport psychology in sporty population.

Nowadays methods of sport psychology are usually divided according to the area which is the object of inquiring – methods of *inquiring into a course of life, observation, questionnaire methods, surveys, psychological questionnaires (inventories), psychological tests, projective tests and group inquiring techniques*. [9], [5]

Methods of inquiring into a course of life – they are important for deciding about the athlete's personality. They belong to a group of rather less standardized, explorative, non-test methods and usually with lower rate of objectivity. A typical example is *anamnesis*, when an athlete recalls his/her past and replies in a direct (controlled) interview or gives answers to written questions relating to psychologically important issues in the childhood, in school, in sport, in the family or in his/her state of health (family, school, medical, sport or hobby history). Similar questions might also be answered by people who know the person well (parents, a teacher, a coach). For inquiring into life circumstances it is sometimes possible to use results of an activity (a diary, a training diary, progress in personal records, attendance at training and competitions, various pieces of work/creations, correspondence).

Another important method from this field is *observation*. Participant observation is one of the most widely used psycho-diagnostic method in sport psychology, it is often a source of "a qualified impression" of the object being monitored in natural events. The objectivity of observation increases with processing the system of observed features, so called criteria, alternatively with the methods of registration of these features – here psychological assessment and assessment scales are involved. First of all time keeping of the game progress, keeping record of individual attempts and their success rate have a tradition in sport.

Questionnaire methods are very attractive, in a short time we

can obtain a large amount of data that can be assessed. However, the deciding factor is the respondent's ability and willingness to provide relevant information about himself/herself on the basis of personal introspection (self-observation). A disruptive moment is a lack of self-criticism of respondents, alternatively their inclination to socially required replies resulting in fabricated answers (following their own hypothesis – what information is suitable to give, what might be expected to be awarded by "positive points", for example in connection with nomination).

In principle it is necessary to distinguish the *surveys* where the respondent's opinion of a current issue is obtained through loosely formulated questions. The answers are usually processed in percentage. The visual result is expressed by circle diagrams – here individual segments represent what someone thinks or does within the interviewed selection of respondents. Thus the views of sport spectators are often presented.

Standard *psychological questionnaires (inventories)* differ from surveys. They are usually used for detecting characteristics of a personality. The items of psychological questionnaires are subject to a demanding prior preparation when their validity and reliability in relation to the required psychometric criteria are reviewed. This standardizing process results in a questionnaire material (handbook). It documents what standardizing patterns of tested persons were used to create the questionnaire, what the measured psychometric characteristics are as well as the standards for defined samples of respondents – according to the age, sex or education. To avoid subjective distortion of the answer by the respondent the scale of self-criticism (so called "lie score") is included. It helps sort out inadequate answers. A lot of questionnaires in sport psychology were standardized abroad and they cannot be used in a different cultural and language environment just after the translation, as it often the case. The transfer means re-standardization in new conditions and comparison to find out whether the transfer shows similar psychometric characteristics as the original method. [5]

Psychological tests assess the performance of a tested person and thus they have a higher objectivity rate than the previous methods. The best-known are intelligence tests focused on mental performance. In sport psychology tests focusing on perceptive, sensomotor performance (reactibility tests, attention tests, psychomotor pace and sensomotor coordination tests) are widely used. They can be a source of information on the current mental state of an athlete (fatigue, a degree of regeneration or acclimatization). Historically these performance tests had a "pen and paper" character (crossing out, searching, numerical, tapping), later separate performance tests were constructed (coordination, labyrinth, push button, support, dispositive). Nowadays they have a character of computer peripheral and programs.

Projective tests are based on the assessment of a fantasy performance of a person. They are based on the hypothesis that people project their inclinations, their wishes, motivation tendencies into their fantasy production. They often hide them and are not even aware of them. Content analysis of fantasy products can help psychological diagnosis.

In tests we can also include measuring of psycho-physiological variables connected with activation level of an athlete, his/her emotiveness and a current mental state – heartbeat and breathing frequency, blood pressure, temperature and electric conductivity of skin, electro potentials of muscle and brain activity. Increasingly their measurement moves from laboratories to field conditions of a sport activity thanks to the technical progress (so called telemetry). A lot of measured parameters have already been used in practice as a biological feedback for the control of movement intensity, relaxation or regeneration.

Group inquiring techniques differ fundamentally from the previous ones due to their focus on group dimension of a sports activity. The subject matter is not an individual but a social group of athletes. The measurement result represents a summary of individual reactions of single team members. Technically these group inquiring techniques might be similar to assessment scales or interviewing methods but the goal is to capture group dimensions as a whole. The best-known group are *sociometric techniques*. They are based on the process of choice or refusal among the group members – as a result a sociogram is created. It is a graphic representation of positive and negative relations in a group. Sociometric indexes can be indicators of an individual's social position in the group (popularity, authority) and they can be used in nomination of individuals into a play set. A simple and rather effective method is a principle of collective assessment. It is based on the fact that the members of permanent teams know each other very well and they can determine quite easily who is in some respect the best and who is the worst in the group. Experience shows that setting a ranking in the group according to physical abilities through collective assessment is faster and more accurate than a similar result achieved by the measurement of abilities of each group member.

The clear overview of methods works only for a basic orientation. More detailed information can be found in catalogues of firms engaged in the sale of psycho-diagnostic methods [4]. The application of these methods is connected with the supervision of a qualified psychologist. Practically applicable requirements for the use of these methods are also linked to highly specialized forms of training.

In our research we used *psychological questionnaire method (inventory)* for obtaining data from both groups of respondents – top athletes and sportsmen representing common population.

D. Influence of physical activities on mental health improvement

The reasons why physical exercise can affect mental health have not been scientifically exactly described yet [7]. However, a few theories have been proposed and some of them are more supported by the professional public than others [8]. These various theories are basically either psychological or physiological. Further in the text we do not present all of them but only those *supported in research findings* [8].

Physiological explanations

Rise of endorphin levels. Endorphins are hormones that block the pain, improve the mood and increase the feelings of well-being [8]. Hormones are chemical substances produced by human body and affecting the function of certain organs and processes. For example, endorphins are released in the period of stress where we can include both *aerobic exercises* (with the access of oxygen, primarily they reduce the amount of body fat and increase active body mass – muscles, e.g. cross-country skiing) and *anaerobic exercises* (without the access of oxygen, they focus on building physical condition and strengthening heart, they need a lot force and so called oxygen debt is produced during these exercises – e.g. exercises in fitness centre).

It is possible that just these endorphins cause exercise "high", i.e. the feelings of euphoria and exhilaration sometimes experienced during a moderate to intensive aerobic activity. The release of endorphins during exercises might also be the cause of decreased anxiety level, tension, anger and depression which is observed after the physical activity is finished. Doing exercises regularly may lead to the increased release of endorphins during every exercise, may increase the individual's sensitivity to hormones and thus induce slower endorphin degradation. [11]

Changes in brain biology. Changes in brain biology might potentially be the cause of improved mental health including more positive moods and intellect abilities such as learning and memory [12]. According to some research findings regular physical activity is connected with health, survival and production of brain cells together with their organization and functionality. Physical exercises may also lead to the increased blood inflow to the brain. [8]

Rise in monoamine neurotransmitter levels. Neurotransmitters or neural transmitters are chemical substances that enable nerve cells to communicate with one another or with other cells, e.g. muscle fibre cells. Monoamines is a collective name for the groups of neurotransmitters related to depression and anxiety [13]. These are the substances such as dopamine, adrenalin (in the USA the term epinephrine is used), noradrenalin (norepinephrine) and serotonin. Antidepressants increase the level of these neurotransmitters. Their levels may also be increased by physical exercises, which might explain the decrease of depression and anxiety during regular physical activity. [8]

Reduction of stress hormone reaction. In the period of mental and physical stress (increased load) the brain releases a number of stress hormones to help the body prepare for coping with big demands connected with the load [11]. The increased levels of these stress hormones are linked with depression, anxiety and a negative mood. Although a single exercise might lead to a release of these stress hormones, in the course of time a regular training leads to the reduction of their amount released during the same intensity of load. Thus potentially as a result of regular exercises the body produces lower amount of stress hormones when facing the load. [13]

Psychological explanations

Self-esteem improvement. Self-esteem is related to the value that an individual ascribes to himself/herself. It is an important part of mental health. Low self-esteem is also connected with mental problems such as depression. When people start to devote themselves to exercises, sport and physical activities, their skills, fitness as well as appearance (e.g. loss of weight) may improve. As a result of better skills, fitness and appearance their self-esteem may also improve [14]. The real improvement of skills, fitness and appearance is not always necessary. Self-esteem might get better even by one's belief in the improvement of those three above mentioned aspects [6].

Social support. Perhaps the improvement of mental health is not caused by a physical activity itself but by the interaction with other people and the social support that an individual experiences during the exercise [15]. So far psychologists of physical education and sport have not studied this explanation by a social support too much and thus more research is needed. [8], [16]

Summary

Each of these professional explanations has a certain amount support, none of them however provides a thorough convincing answer to the question why there might be a connection between physical exercise and mental health. Most of the evidence relating to the changes in brain biology, for example, comes from the research on animals and thus it is not certain whether these findings can be applied on humans [8].

No explanation on itself is probably sufficient to clarify reasons for mental health improvement in physical exercises. Mental health consists of thinking, feeling and behaviour. None of the above mentioned explanations includes all these components. Thus the answer to the question why mental health improves during a physical exercise could be probably found *in combination of the stated theoretical approaches*. [7]

II. Theoretical basis

A. Anti-stress effects of sport

By its nature sport as a physical activity has *anti-stress effects*. Their physiological basis lies in the exertion character of sport activity. The result of GAS (General Adaptation Syndrome) is neurohumoral adaptation, i.e. increased readiness of an organism for washing out hormonal substances which primarily prepare the organism for muscle strain. This preparatory reaction of the organism probably evolutionarily developed in accordance with the instinctive reaction to a stressor represented by an animal fight or flight. In both cases there is a necessity of mobilization readiness and energy output which are ensured just by this neurohumoral response to stress. [17]

Health harmful consequences of stress consist in accumulation of unused metabolites of stress responses in the organism. In nature a stressed animal which is attacking or running away instinctively needs stress metabolites for muscle work. Modern humans usually do not accompany their social stress with increased physical activity, the metabolites stay in

their blood and in the course of time they can contribute to a development of so called *lifestyle diseases* (hypertension, diabetes, cardiovascular disorders). Sport exertion after a hypokinetic stressful day can help by *consuming the accumulated metabolites in the organism* and thus act as health prevention of lifestyle diseases development. There is a practical psychological problem in the fact that the tiredness from a working day, though mental, has global effects and a person has to force himself/herself into an after-work sport activity more than into a morning, pre-work sport activity, which has rather warm-up character. Therefore after-work sport must have more enjoyable and attractive form. [3], [18]

Anti-stress influence of sport consists in distracting a person from a serious existential work level and transferring him/her to an enjoyable level of play. This is a mechanism of *emotional retuning* with good psycho-hygienic effects. The experience of joyful absorption, so called *flow* has harmonizing effect and is an expression of quality of life improvement. The occupation and everyday duties lead to accumulation of tension, which is felt as worries. This unpleasant tension decreases in sport. We speak about the mechanism of *relaxation or taking our mind off things* – other emotional reactions overlay and relieve previous emotional tension and stress is reduced. [19]

In relation to anti-stress influence of sport the mechanism of *compensation* can be mentioned. It is balancing or substituting a certain activity. For example, a sedentary occupation in technical professions often leads to a psychological tension. It can be compensated by a sport activity that has within a mental hygiene anti-stress and positive effects. *The effect of active relaxation* is confirmed. Thus a physical activity does not intensify mental tiredness but it tends to reduce it.

There is a special importance of sport as a compensation for school children, not only in biological sense but also psychological and social. Sufficient physical activity is important for the child's growth as early as in the pre-school age. "Rollicking" often underestimated by adults has clearly positive *psychosocial and psycho-hygienic importance*. In addition to stimuli for physical development, it is also a source of compensation emotiveness. Current children are often deprived of this active motion component of emotiveness development and they seek compensation in imaginary and virtual emotiveness. Unfortunately, they sometimes also provoke this emotiveness chemically, which leads to a drug addiction. Sport as a substitution of emotional vacuum – boredom – has a primary importance for young people.

Top sport has a rather serious nature of work activity under a contract. It can be a source of overtraining and then it is necessary to proceed to a specific measure within the psychological preparation which is based on routine measures, the reduction of intensity and monotony of training, the increase of preparation diversity. Primarily regeneration and relaxation are necessary. *Relaxation and compensation exercises*, alternatively *compensation sports* belong to this area.

Sports preparation can be understood as increasing resistance to specific loads including frustration tolerance. A sports approach means perceiving even difficult life circumstances with grace and a decisive attitude that these situations need to be managed and endured. The general basis of resistance is *human fitness*. [3]

B. Sport and quality of life

The quality of life is a multi-dimensional term, World Health Organization (WHOQOL Group, 1998) determined six quality of life areas which are important both for clinical and non-clinical population: *physical health, mental condition, amount of independence, social relationships, environment and spirituality, religious belief and personal confidence.* [4]

Sport represents an enjoyable physical activity and has considerable *euphorigenic potencial*. Already in ancient times performance and its improvement were emphasized, which still applies to top sport. However, in recreational sport nowadays there is a shift from the performance concept towards the enjoyment concept, the change *from fitness to wellness*. The fitness concept stressed as a main goal primarily physical condition and its biological parameters. It was to be achieved through exercises, frequently of monotonous nature. Now the psychological circumstances of exercises and overall personal *well-being* are more prioritized. Sports with a varied content, rich emotional dynamics, often associated with a risk factor and technical equipment control are getting to the forefront of interest. *Adrenalin* enjoyment sports are beginning to be increasingly discussed.

In the last decades the subject of *quality of life* [1] has been following the philosophical issues of human happiness and meaning of life. As crucial for the quality of life are usually considered: somatic condition and motoric functions (self-sufficiency), mental normality, survival attributes (abilities and habits), healthy lifestyle, developmental care (preferably functional family and anchoring in relationships), adequate material conditions and vitalizing environment. These are followed by the diversity of lifestyles and interests. Sport is one of the manifestations of quality of life and the level of life standard. At the same time it is the expression of *internal vitality and joy*. A person doing a sport has extra physical and mental energy in comparison with common population. The *somatic* area is modified by sport to a healthy level – physical activity is natural strengthening of muscles, bones, cardiovascular and respiratory systems. The benefit is also apparent in the area of appearance, aesthetics and thus a healthy self-esteem is increased. The *mental* area is affected by sport primarily in the field of amusement which supports a positive mind set. [9]

In spite of the competitive environment and certain egoism of some individuals, sport is the opportunity for regular interpersonal communication, filling *affiliative needs*, it enables rich group dynamics in a team. Thus the social function of sport can significantly contribute to the quality of life improvement. [16] When performing sport activities a modern man/woman has the possibility of close contact with natural forces (sun, water, wind, snow, weather changes, mountains, rocks) and in this way also the *environmental dimension* of life is developed, which is very important for current predominantly technical civilization, mainly from the point of view of regular mental hygiene.

C. Evaluation in sport

Sport activities are subject of measurement. Sportspeople are mostly extroverts, they show their achievements and expect to be evaluated. Social comparison and the subsequent recognition of achievement constitute one of the greatest psychological awards in sport which currently represents a certain model of competitive environment.

Social and relational standards belong to sport, they mean mutual comparing, creating order, determining the best and worst, preparation of podium. The specific example of social standards are statistical standards when the performance is compared with rankings, population standard of performance, annual or long-term average figures. This evaluation enables *psychological resilience*, making use of previous experience for self-development, handling new situations, performance increase – prestige of sportsmen and record listings are based on it. Top sport cannot exist without the use of these relational standards. [7]

Problems occur when social relational standards are used in recreational sport or compulsory sport in school environment. This evaluation does not suit to people whose performance is below average, they have no talent and skilfulness. They are always at the bottom of rankings, which brings frustration and so they lose motivation and give up a sport activity. They remain untrained, unskilful, overweight and physically neglected. But in fact kinetic stimuli are the exact thing they need for their development, sport is one of a few possibilities how to get rid of kinetic shortcomings and at the same time reduce unnecessary anxiety. Hypokinesis of untrained individuals usually leads to health problems in older age. *Individual relational standard* means the evaluation related to one individual, i.e. relative, expressing a ratio between his/her previous performance, average performance or his/her own performance prerequisites. Improvement is acknowledged as a success although the absolute level of the performance in social comparison does not mean much. The use of this relational standard is psychologically advantageous for finding out so called *self-efficacy*, one's own fitness. It is also possible for the evaluation of less talented individuals, their motivation for doing sport is strengthened this way. It suits to common activities of talented and talentless individuals or in heterogeneous performance environment. [19]

The above mentioned way of evaluation is up-to-date for example in compulsory school physical education. For the motivational reasons the individual relational standard is more recommended in all subjects for working with pupils lagging behind. The research among teachers on the use of relational standards has shown that physical education teachers as former athletes are fixed to the permanent use of social standards. The evaluation on the basis of individual standards is used significantly less by them than by teachers of other subjects. It is not surprising that school physical education has rather demotivating effects on below-average physically gifted pupils. Sport gifted individuals due to successful evaluation will always find their way to sport but those without talent are often eliminated despite the fact that sport activities have their importance in a current people's lifestyle and sport is a welcome opportunity for an overall personality development.

D. Research issues

Mental and physical heath

The belief of connection between physical exercise and mental health is known from the history of ancient times. It is reflected in the message *mens sana in corpore sano – there is a healthy mind in a healthy body.* The science started to be interested in this relation much later and it has not brought a closer understanding of the relation between physical exercise and mental health until the recent years [7], [20]. In 2004 the representative of the British Ministry of Health came up with the thought that *it is necessary to think about physical activities not only with respect to their therapeutic effect on mental illnesses but also due to their impact on mental health.* (Ministry of Health, DH, 2004: 58-59).

With the growth of intensity of physical activity the positive mood decreases and the negative mood increases even though the reaction to the load is not the same with all people. After finishing exercise the *back-reflection effect* occurs during which the mood improves. Although further research needs to be conducted, it is possible to say that people doing regular exercises are less likely to be depressed. Moreover, exercises are recommended as a suitable therapy of mild to medium depression, in combination with other interventions (pharmacotherapy or psychotherapy) and under the control of a qualified mental health specialist. Research confirms the British Ministry of Health statement that active people have fewer symptoms of anxiety than inactive people. After all, physical activity significantly affects people with bad physical condition and high level of anxiety. It turned out that exercise is a feasible intervention for cancer patients, even those who are undergoing chemotherapy and suffering from an acute stage of the disease – here a number of benefits were recorded, such as the quality of life improvement and a depression decline. Qualitative studies revealed the importance of group cohesion and the identity within the group doing exercises as well as the fact that exercise helps patients change self-reflection and set goals for their physical functioning in everyday life. Teenage and adult diabetics that are physically active show higher levels of quality of life than those who are not engaged in any physical activity. Exercise also helps patients with heart diseases improve their mental health. Qualitative research has shown that as in the case of patients suffering from various immobilizing chronic conditions, exercise also helps cardiacs regain confidence in themselves which might have been lost as a result of the disease. [21]

Frustration tolerance

Frustration is defined as a state threatening the integrity of organism when a person must engage all abilities to protect himself/herself. The effort based on the natural necessity of satisfying a person's needs is blocked. In a narrower sense, frustration is the result of dissatisfying biologically primary, instinctive claims or the failure in achieving a goal, which is accompanied by feelings of destruction. As one of the determinants of human behaviour frustration is sometimes

incorrectly mistaken for deprivation or the phenomenon of unfinished activity, which has similar symptoms as frustration.

Manifestations of frustration fall into the area of perception and behaviour disorders and often acquire the character of neuro vegetative or psychosomatic symptoms. They depend not only on the intensity and length of duration of frustration but also on a *person's resistance to frustration – so called frustration tolerance*.

The ability of frustration tolerance is connected with inborn properties of an individual (temperament, emotional stability versus instability) and further with influences of social environment (family influence and acquired experience). [22]

Although frustration can cause aggression, anxiety as well as neurovegetative disorders [19], it is an inseparable part of human life. Gradual and bearable frustration loading of organism even leads to increased psycho-physiological resistance of an individual.

Dealing with stress

Stress is generally understood as exertion, load, as an adaptation stimulus, as a demanding situation that must be managed by an athlete – physical load (training) and mental load (competition). The following degrees of load can be distinguished: extreme, excess, boundary, increased, adequate, optimal, negligible. In fact, load is any energetic demand on the organism. [23] There is a known concept of organism as a balanced system (homeostasis) which is deflected by a load and tends to regain the balance again. According to the adaptation theory [24] every other analogous load causes a smaller deflection, the organism gradually adapts to loads. The essence of training programmes for athletes is based on this fact.

In the 20th century the *theory of stress* brought a new approach to the issue of load. Its author is Hans Selye [17] who found out through experiments that all loading stimuli (stressors) from a certain intensity lead to triggering a unspecific reaction in the organism (i.e. always the same regardless of the initiator of stress), called general adaptation syndrome (GAS). It progresses in three phases: 1st – alarm (alarm reaction), typical for mobilization, inefficiency, 2nd – resistance, defence by drawing from energy storage, 3rd – exhaustion, spreading the reaction onto the whole organism, collapse. The criterion of GAS progress is production of hormones preparing the organism for physical exertion.

In fact stress is intensive emotion with all the activating consequences. The asthenic emotion is called distress, the sthenic emotion is eustress. Depending on the place affected by a stressor we speak about physical stress when it affects periphery (most often pain), and mental stress which is cerebral, brain, mental. For example, the ankle distortion means the physical stress for an athlete and the disqualification from the race is the mental stress. The response of the organism to both stress types is the same, unspecific, global. It differs only in intensity. The main criterion is the amount and kind of hormones identifiable in blood, saliva etc. (corticoids, adrenalin, noradrenalin, cortisol, hydrocortisol). [25]

The most frequent stressors in sport are expectation based tension (see pre-start condition, fear when taking a risk), demands of the programme, defeat, injury, loss of physical condition or disqualification.

Intensive and long-term distresses mean quality of life worsening and they can have an unpleasant impact on health – today this issue is dealt with by a modern field of *psychosomatic medicine*.

Psychosomatic symptoms

Psychosomatic symptoms in a stress situation during sport activities can be classified into three groups:

Organic – palpitation (the heart beat is too strong, fast and irregular in relation to the current exertion), losing breath and sweating without an exertion cause, chest pain, cramps and pain in the bottom part of stomach, metabolic disorders – loss of appetite, enormous muscle tension, especially in the area of cervical and lumbar spine, migraines that spread from the neck to the top of the head and forehead.

Emotional – sharp mood fluctuation, hypochondria, dreaming, autistic thinking, lack of concentration, neurotic symptoms, inadequate tiredness, fear from social contact, loss of empathy, impulsiveness.

Behavioural – decline in performance, loss of physical condition, worsened quality of training preparation, taking anaesthetics, disorders of life rhythm (insufficient sleep, chronic tiredness), excesses in behaviour, tendency towards isolation. [9]

As it can be concluded from the previous enumeration, the difficulty in diagnostics results from variety and also contradiction of symptoms which are sovereignly individual. Unlike a physical illness, which manifests itself e.g. by a fever, the situation in psychosomatic symptoms is unclear and the affected person often refuses to admit the seriousness of his/her condition. A frequent danger in sport is overtraining, which has stress effects. Psychological dangerousness lays in the fact that it is the result of good intentions, increased motivation and big effort to assert oneself. The cause are big training dozes and underestimating the regeneration of performance disposition. A lot of coaches of top-level athletes still see regeneration as a luxury. It results in protracted stress conditions. Therefore it is absolutely essential not to underestimate psychosomatic symptoms in a stress situation, regard them as a warning signal and adopt routine measures to eliminate them.

III. Methodology

A. Method of research and a group of respondents

The method of a questionnaire survey was used in the research on the basis of subjective evaluation according to the questionnaire by Micková (see Table 1, Table 2 and Table 3). [26], [27]

The research was focused on finding out stress factors in three sectors:

1) frustration tolerance – the form of YES/NO questions was used here
2) handling stress, i.e. behaviour in a stress situation – the form of questioning by means of assessing scale was used and two aspects of the research were followed here – the

amount of emotional reaction to stress and the amount of using malcoping (harming) strategies

3) psychosomatic symptoms - the form of questioning by means of assessing scale was used here

B. Group of respondents

50 athletes in total were included in the research set. Most of the athletes were secondary school or university students.

Top-level athletes – cross-country skiers, men; n = 25; age 19 – 25 years, average 21 years

The athletes were selected into this set according to the criterion of sport performance efficiency. At the time of the survey they belonged to the 1st class of performance efficiency and they regularly took part in the races of Czech Cup or a higher category (at least 5 races). At the same time 15 athletes from this set were or still are the members of the representation team. However this was not the condition for inclusion into the research. For none of the athletes sport was the source of livelihood. With regard to various training methods it can be assumed that at the time of racing period, during which the research was carried out, the average weekly sport activity occupied between 10 and 15 hours. It should be noted that the athletes of this group belonged mostly to the Czech performance top level.

Common population doing sport as a leisure activity - men; n = 25; age 21 – 25 years, average 22.5 years

The athletes selected into this set do a sport regularly in various sport activities, maximum of 8 hours a week (the average of a weekly sport activity was 5 hours in this set), at the same time they were not included in any representation team and currently did not have their performance efficiency certified in any sport. On the basis of the collected data it can be said that this group represents common population doing sport as a leisure activity which mostly does not interfere with the life of the athletes.

C. Procedure of conducting the research

Modern technologies were used for doing the research. It was carried out with the help of the company Google Inc., thanks to which the questionnaire was converted into electronic form and the company Facebook Inc. enabled direct communication with the respondents – each of them was approached individually on the basis of pre-prepared list of names. Thus obtaining proper answers only from the selected people was guaranteed. The research was conducted and gradually statistically processed in the years 2013-2014. 88 questionnaires in total were sent off, out of these 64 (73%) completed questionnaires were used.

Table 1. Frustration tolerance questionnaire (yes/no) [26]

I can estimate the work and do not feel the urge to really think through all the essentials.
It is natural for me to get on with and respect people who have different opinions from mine.
I accept full responsibility myself rather than share it with others.
I can concentrate on one thing and at the same time clean my mind from other things even though they are equally important.
I am proud when I am able to manage work faster than most of the others.
Clear definition of time for a task is very important for me.
I usually try to cope with problems in an effective and systematic way.
I always set to work with enthusiasm.
I like competing – at work and elsewhere.
I know I am as good as anyone else.
When I solve a problem I usually hope it will turn out well.
I devote a lot of time to work – it is my own decision.
I can usually divide a problem into manageable parts.
I can rely on help from my family and friends.
I am very ambitious.
I sometimes have more work than I am able to manage.
I tend to participate in a lot of various ideas and plans.

Table 2. Dealing with stress – my behaviour in stress situation questionnaire (0-3: never, sometimes, often, always) [26]

I am overcome with anxiety.
I get angry, I must shout my feelings out of myself.
I speak about my stress with my colleagues.
I am angry.
I try not to return to the problem and its context.
I go back to past experience.
I try to understand the situation and on the basis of that to do something
I start to panic.
I have a feeling of hurt.
I take tranquilizers.
I feel disappointed.
I underestimate and criticize myself.
I buy myself something for pleasure.
I feel miserable.
I cry, fall into apathy, I feel sorry for myself.
I am dissatisfied.
I do something I enjoy.
I feel tension.
I eat more or smoke more.
I meet up with friends.

Table 3. Psychosomatic symptoms questionnaire (0-3: never, sometimes, often, always) [26]

I feel tension in nape and back muscles.
I suffer from headache.
I suffer from stomach ache.
I suffer from speeded-up heart beat (sometimes connected with palpitation)
I have memory disorders.
I feel tired and I feel lack of energy.
I suffer from insomnia.

Set 1 – Top-level athletes – cross-country skiers: Sent off 40 questionnaires, returned completed 30 (75%).

Set 2 – Common population doing sport as a leisure activity: Sent off 48 questionnaires, returned completed 34 (71%).

Consequently the number of respondents was reduced to 50 (25 in each of the two sets) due to meeting assigned criteria.

Individual components of the questionnaire were evaluated in points. The statistical significance of differences was owing to a small number of subsets (n=25) calculated by means of Mann-Whiteny U-test. For statistical processing a complement for Microsoft Excel, Trial version of the program SigmaXL was used.

D. Characteristics of stress potential zones

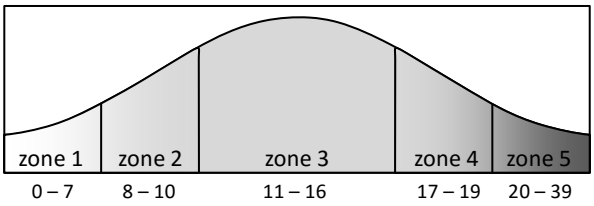


Fig. 2. Zones of stress potential

Zone 1: The stress level is *very low*. The personality needs to be encouraged and motivated in his/her life so that they could use their abilities better. Here it is necessary to realize the existence of so called positive stress – eustress which enables to manage the demands of modern life, strengthens and develops a human personality.

Zone 2: The stress level is *low*. It can be connected with introvert orientation of the personality and a stabilized way of life progressing without changes and excitement. The personality is in a rather balanced life situation and does not have to be afraid of stress-related diseases. However he/she does not use all their abilities. It is necessary to place bigger demands on themselves, set more ambitious goals and overcome passivity.

Zone 3: The stress level is *average*. It is an *optimal zone* of stress potential. Most of the population find themselves in this zone. In the personality's life the periods of increased load alternate with the periods of peace and relaxation. For achieving goals the certain stress level is necessary but it must not be permanent and long-term. Increased load-peaceful condition rhythm enables a person to live a balanced and satisfying life.

Zone 4: The stress level is *high* and it means a warning signal. The personality should explore individual areas of his/her life and consequently decide which problems need a quick solution. This way mental problems as well as threatening physical problems can be turned away. It is time to change the lifestyle and prevent complications. It is necessary to seek advice from close friends and relatives or ask for a professional help. It is also advisable to get to know strategies of coping with excessive stress.

Zone 5: The stress level is *dangerously high.* The personality is currently experiencing abnormally high stress. He/she has serious problems requiring an urgent solution. The personality is no longer capable of helping himself/herself a so it is necessary to seek professional help of a psychologist or a psychiatrist.

IV. Results

A. Zones of stress potential

The limit values of individual stress potential zones were converted into their percentage in the scale 0 (0%) up to 39 (100%; see Fig. 3). Also the point results of each respondent from individual questionnaires were converted into percentage.

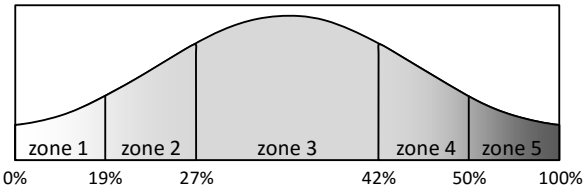
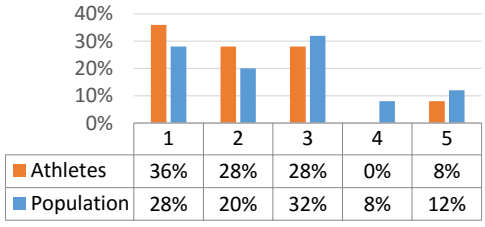


Fig. 3. Zones of stress potential converted into percentage

B. Frustration tolerance

First of all numbers of inclusion in stress potential zones were compared for frustration tolerance of the group of top-level athletes – cross-country skiers and of common population sportsmen (see Fig. 4).



	1	2	3	4	5
Athletes	36%	28%	28%	0%	8%
Population	28%	20%	32%	8%	12%

Fig. 4. Comparison of numbers of inclusion in zones for frustration tolerance of groups of top-level athletes and common population sportsmen

Half of the group of **athletes** (approx. 12 people) range on the border of zones 2 and 3 (18-29%). Other members (other approx. 12 people) diverge from the average of the group by their inclusion in zones – they are more divergent.

Half of the **population** group (approx. 12 people) is included in zones 2 and 3 (18-41%). The group does not contain too different/divergent individuals. Other members (approx. Other 12 people) do not diverge from the group average by their inclusion in zones as in the athletes group. Further a boxplot representation of the amount of frustration tolerance in athletes and population groups was created for a more detailed comparison. (Fig. 5)

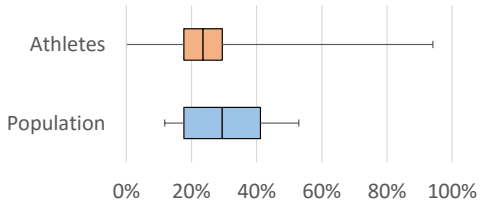
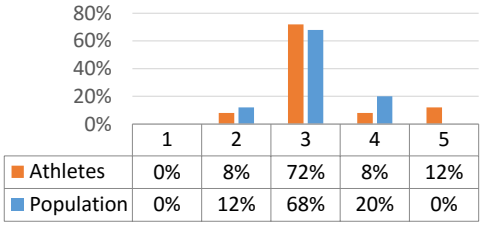


Fig. 5. Boxplot representation of amount of frustration tolerance in top-level athletes and common population sportsmen

C. Handling stress

First of all we compared numbers of inclusions in zones for optimal handling stress of the top-level athletes group and the

group of common population sportsmen (Fig. 6) a then for a more detailed comparison a boxplot representation of the amount of stress handling by top-level athletes and common population sportsmen was created. (Fig. 7)



	1	2	3	4	5
Athletes	0%	8%	72%	8%	12%
Population	0%	12%	68%	20%	0%

Fig. 6. Comparison of numbers of zone inclusions for optimal handling stress by groups of top-level athletes and common population sportsmen

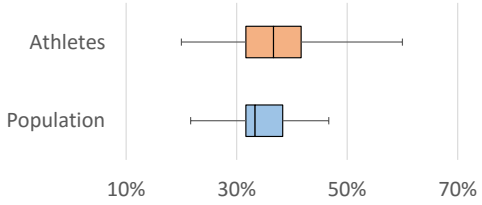


Fig. 7. Boxplot representation of amount of stress handling by top-level athletes and common population sportsmen

68% of group members of **athletes** fall into stress zone 3 which is the healthiest one with respect to handling stress. 72% of group members of **population** again fall into stress zone 3 which is the healthiest one with respect to handling stress. (Fig. 8)

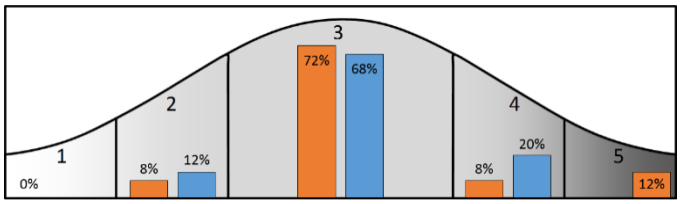
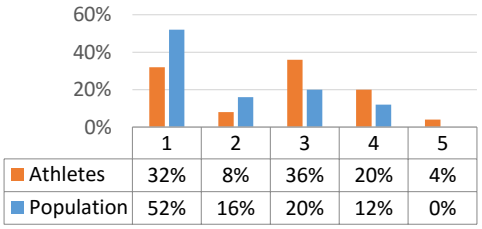


Fig. 8. Number of psychosomatic symptoms in groups of top-level athletes and common population sportsmen

D. Psychosomatic symptoms

Further the research focused on the comparison of the numbers of inclusions in stress potential zones for psychosomatic symptoms in the groups of top-level athletes – cross-country skiers and common population sportsmen. (Fig. 9)



	1	2	3	4	5
Athletes	32%	8%	36%	20%	4%
Population	52%	16%	20%	12%	0%

Fig. 9. Comparison of numbers of inclusions in zones for psychosomatic symptoms in groups of top-level athletes and common population sportsmen

Approximately the same number – one third – of group members of **athletes** occur both in stress zone 1 and zone 3. More than a half of group members of **population** are from the point of view of psychosomatic symptoms included in stress zone 1.

Consequently, for a more detailed comparison a boxplot representation of amount of psychosomatic symptoms occurrence in top-level athletes and common population sportsmen was created. (Fig. 10)

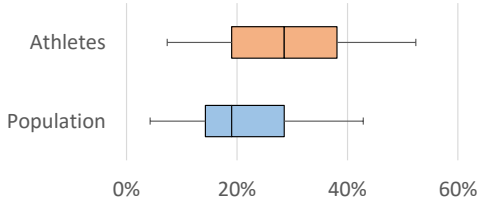


Fig. 10. Boxplot representation of amount of psychosomatic symptoms occurrence in top-level athletes and common population sportsmen

Further we focused on the comparison of amount of individual psychosomatic symptoms in the groups of top-level athletes and common population sportsmen (Fig. 11)

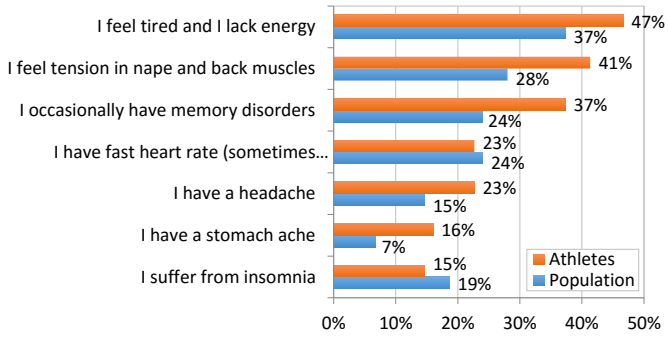


Fig. 11. Comparison of amount of individual psychosomatic symptoms in groups of top-level athletes and common population sportsmen

Consequently, the number of psychosomatic symptoms was found out in the groups of top-level athletes and common population sportsmen. (Table 4)

From the above mentioned symptoms the group of top-level athletes show feelings of tiredness and lack of energy most often (47%). In the group of common population sportsmen the situation is similar, the feelings of tiredness and lack of energy are shown also in the highest rate (37%).

The second position in the table is held by feelings of tension in nape and back muscles in the group of athletes (41%) and also in the group of common population sportsmen (28%).

In the third place top-level athletes show memory disorders (37%) and common population sportsmen fast heart rate sometimes connected with excessive heart beat (24%).

Table 4. Number of psychosomatic symptoms in groups of top-level athletes and common population sportsmen

	Population	
1	I feel tired and I lack energy	37%
2	I feel tension in nape and back muscles	28%
3	I have fast heart rate (sometimes connected with excessive heart beat)	24%
4	I occasionally have memory disorders	24%
5	I suffer from insomnia	19%
6	I have a headache	15%
7	I have a stomach ache	7%
	Athletes	
1	I feel tired and I lack energy	47%
2	I feel tension in nape and back muscles	41%
3	I occasionally have memory disorders	37%
4	I have a headache	23%
5	I have fast heart rate (sometimes connected with excessive heart beat)	23%
6	I have a stomach ache	16%
7	I suffer from insomnia	15%

V. Application for Independent Testing

The data for this research was obtained by individual respondents filling in printed paper questionnaires. That brought a few difficulties such as the distribution of questionnaires, time and space limitation for filling them in, insufficient anonymity, collection of completed questionnaires, conversion of data into a digital form and its statistical processing [28].

In order to eliminate these problems in future or at least reduce them considerably, an on-line application was created which facilitates the whole process significantly [29]. Users then do not fill the data in the paper forms but on-line in web forms, which is more preferred [30]. Thanks to that it is also possible to reach far larger sample of respondents because apart from those directly involved in the project other "anonymous" volunteers can participate in the research. All the recorded data is available immediately after it is entered and thus it can be automatically continuously evaluated.

This application is freely available on the address http://qol.alltest.eu/stress. Here we can find a signpost to all three questionnaires relating to stress: Frustration tolerance, handling stress and Symptoms of stress. The first one includes yes/no question type and for better user comfort the answer is selected only by clicking (with a mouse or a finger on the touch device) on the icon which gradually switches over from the original state of a question mark (answer not selected) to the option yes (for the approval of a statement on a given line) and consequently no (for the disapproval of the appropriate statement; see Fig. 12)

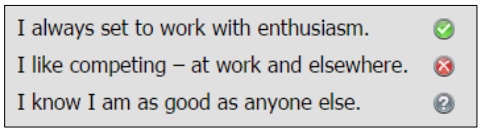


Fig. 12. Illustration of filling answers in Frustration tolerance questionnaire

In other two forms answers are given on a scale 0-3, which was simplified here by the selection of number of stars. It expresses a degree of agreement with a given item (1 star – total disagreement, 4 stars – total agreement; see Fig. 13)

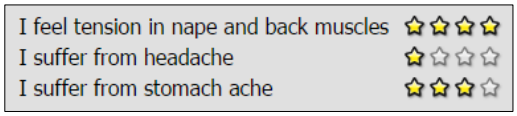


Fig. 13. Illustration of filling answers in questionnaire Symptoms of stress

After filling in all the items in the questionnaire the user clicks on the push button *Evaluate* and immediately a graphic evaluation [31] is displayed and in percentage put in the appropriate stress zone (see Fig. 14).

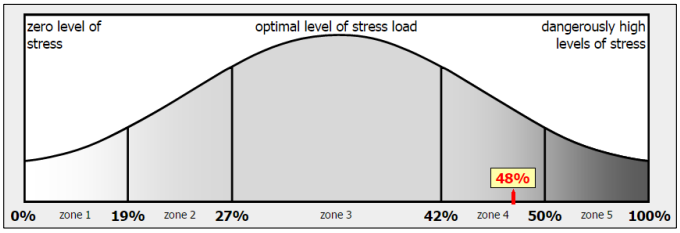


Fig. 14. Illustration of questionnaire evaluation – putting user in stress zone

A constituent part of the questionnaire is also the data for categorization of respondents (see Fig. 15): year of birth (for putting in the age group), sex, occupation (student of secondary school, university student, worker, senior) and determination of intensity of doing sport activities (regularly, sometimes, never). Name and e-mail are optional but in case of filling them in they can serve for the evaluation of the development of individual stress level in time.

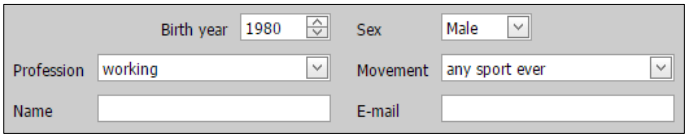


Fig. 15. Illustration of filling in categorization data about user

The complete data of the questionnaire is during the evaluation simultaneously saved in a database on the server for later anonymous, collective, statistical processing. This gives us a possibility to continue in the research all the time with the growing sample of respondents and thus with more relevant results. We should be able to model a population stress distribution [32].

For the future we also plan to extend the evaluation of each questionnaire by the comparison of individual figures with average results of the other respondents [33]. This way users will also get information on what their figures are in relation to the whole population, the same age group, the same sex etc.

VI. Conclusion

Physical activities can represent an effective prevention of the development of both physical and mental illnesses.

Our research was comparing two groups, the group of top-level athletes and the group of common population doing sport on a recreational basis. In the area of *frustration tolerance* it has been found out that a half of the top-level athletes group (approx. 12 people) ranges on the border of the second and third

zone of stress potential (18-29%), where the third zone is understood as an optimal zone, the healthiest one. The other members (the other 12 people) diverge more from the average of the group as far as the inclusion in the zones is concerned. They are more divergent. A half of the common population group (approx. 12 people) is included in the second and third zone (18-41%). The individuals in this group are not as different as in other group. The other members (the other 12 people) do not diverge from the group average as much as top-level athletes do when the inclusion in the zones is concerned.

In the area of *handling stress* it was revealed that 68% of members of the top-level athletes group fall into the 3rd stress zone, which is the healthiest one concerning handling stress. In the population group 72% of its members fall again into the healthiest third stress zone.

In the area of *psychosomatic symptoms* the group of top-level athletes show in the first place feelings of tiredness and energy shortage (47%). The similar situation is in the group of common population doing sport for pleasure where the feelings of tiredness and energy shortage are also shown in the highest rate (37%). The second position in the table is held by the feelings of tension in nape and back muscles in the athletes group (41%) and also in the common population group (28%). In the third place the top-level athletes show memory disorders (37%) and the common population sportsmen state fast heart rate sometimes connected with excessive heart beat (24%).

On the address http://qol.alltest.eu/stress the original electronic application was created in the Czech and English version thanks to which it is possible to reach much larger sample of respondents because apart from those directly involved in the project other "anonymous" volunteers can participate in the research. All the recorded data is available immediately after it is entered and thus it can be automatically continuously evaluated.

The improvement of quality of life, life satisfaction and self-perception belong to the positive effects of physical activities on mental health. It is therefore important for current teachers, doctors and psychologists to include exercise activities in the programmes of prevention and health consolidation. Generally it seems that regular physical exercises of medium intensity, which are chosen by people themselves and adjusted to their physical condition, are beneficial to their mental health. It is necessary to respect the level of condition and skills of athletes. *Aerobic activities* are preferred to power activities. Nowadays medium intensity of exercise, minimum of thirty minutes, five days a week is recommended. The exercise is connected with physical health but it is apparently equally suitable for mental health.

Physical activities, exercise and sport can thus represent an effective *prevention* of physical and mental illness development. However the fear of self-presentation may be one of the factors which prevent people from doing exercises and thus make them deprived of these preventive effects. When introducing exercise interventions specialists must take into consideration *individual routine of exercise* in order to ensure the possibility of achieving optimal benefits for a particular individual.

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