

**Ivan Uher, Zuzana Küchelová,
Iveta Cimboláková, Ján Pivovarník**

Physical Activity and Health

Prace Naukowe Akademii im. Jana Długosza w Częstochowie. Kultura
Fizyczna 15/3, 67-74

2016

Artykuł został opracowany do udostępnienia w internecie przez Muzeum Historii Polski w ramach prac podejmowanych na rzecz zapewnienia otwartego, powszechnego i trwałego dostępu do polskiego dorobku naukowego i kulturalnego. Artykuł jest umieszczony w kolekcji cyfrowej bazhum.muzhp.pl, gromadzącej zawartość polskich czasopism humanistycznych i społecznych.

Tekst jest udostępniony do wykorzystania w ramach
dozwolonego użytku.

Ivan UHER*
Zuzana KÜCHELOVÁ*
Iveta CIMBOLÁKOVÁ**
Ján PIVOVARNÍK***

Physical Activity and Health

Abstract

Health is a condition of complete physical, mental and social wellbeing and not merely the absence of illness or disability. Health is not something one receives but something one has to work and strive towards. This presupposes active efforts from the individual, the family, and the community. In the chain of causative factors and pathological processes which can lead to illness, disability, and death, there are many links, some known and some unknown. Our resources and means must be applied at that point in the causative chain where the best prospects lie for reducing the incidence of illness, disability, and death. Diseases due lifestyle and environmental factors now dominate our health statistics. Material standards of living and personal philosophy of life bear a close relationship to the origin and development of these diseases. In that respect, regular physical activity is seen as an essential component in a lifestyle which itself is the basis for the health promoting idea. In our review we look into physical activity and its influence on health.

Keywords: Health promotion, Physical activity, Education, Wellbeing, Quality of life.

Role of physical inactivity

Active individual participation is decisive in determining whether we can succeed in overcoming the health problems of today. It is, therefore, of importance to approach the common man and woman with information how they

* University of P.J. Šafárik in Košice, Institute of Physical Education and Sport, Slovakia; e-mail: ivan.uher@upjs.sk; zuzana.kuchelova@upjs.sk.

** University of P.J. Šafárik in Košice, Department of Pathological Physiology, Slovakia; e-mail: iveta.cimbolakova@upjs.sk.

*** Matej Bel University in Banská Bystrica, Faculty of Arts, Slovakia, e-mail: karatedojojp@gmail.com.

should live and how they should keep themselves healthy. Physical activity, proper diet, reduction of stress, social support, etc. belong to the contributions, which each individual can make towards the achievement of health. In that context physical activity plays an important role.

We have to look for an answer to the basic question “Will increased physical activity, or participation in sports, lead to a healthier life, healthy aging, of an individual?” As it appears the amount of reliable information as a basis for our recommendations is surprisingly small. There are several of questions we have gone into that have in fact proved impossible to answer in a satisfactory manner, if strict scientific criteria are invoked.

Sometimes justifiable doubt may arise whether there is any possible way of carrying out such investigations in accordance with sound scientific principles. One possible starting point for an inquiry into the question of a relationship between physical activity and health is to study the effects of the opposite situation, namely physical inactivity. The consequences of extreme inactivity or immobilization have been shown to consist of major physiological changes, especially in the circulation, with orthostatic hypotension, a reduction in blood volume and a marked lowering in maximal oxygen uptake [6]. In addition, significant metabolic changes in the form of negative nitrogen balance, lowered glucose tolerance, raised calcium excretion in the urine and muscle atrophy are readily demonstrable [13], [11]. These changes are significant, reproducible and reversible, and the causal relationship with immobilization is beyond doubt. Such changes may justifiably be regarded as detrimental to health because of the lesser ability of the body to carry out the functions of activity of daily living. It is therefore understandable that on the basis of these observations one is tempted to assert that an increase in physical activity beyond what is necessary for the requirements of satisfactory daily living can bring about a further improvement in health. The detrimental physiological effects of extreme inactivity are thus considerable. On the other hand the physiological consequences of more moderate inactivity (a sedentary lifestyle) have been studied only to a very modest degree and under less strictly controlled circumstances.

Relationship between physical activity and health

From the physiological viewpoint, attention has mostly been directed towards the influence of physical training on the process involved in the transport of oxygen from the air to the skeletal musculature. Reliable documentation is available to show that regular physical activity leads to adaptive changes in the dimensions, function and pump capacity of the heart [12]. The increase in aerobic power which takes place as a result of endurance training is not only due to development of the hearts pump capability, but also to circulatory and biochemi-

cal adaptations in the muscles which cope with increased metabolic requirements during prolonged heavy work. Skeletal growth and the degree of mineralization are regulated by a number of factors of which mechanical involvement is one. If the whole body or a part thereof is immobilized, mineral content will be lost from the bones in the inactive part of the skeleton. This is due to both, increased osteoclast activity and bone degradation and diminished bone formation because of reduced osteoblast activity. However, to what extent increasing the level of physical activity beyond the daily level will lead to an increase in skeletal mass is uncertain. It has been reported that the strength of the tendons and ligaments attachment to bone increases with training and weakens with immobilization [1]. The changes which take place in ligamentous structure itself as a result of training are both metabolic and morphological and are related e.g. to a rise in aerobic enzyme activity and thickening of the fiber of the ligament. Regular physical training can contribute to a reduction in body weight. It has been objected that physical activity would increase the appetite correspondingly, so that no weight loss would occur. However, investigations have shown that this is not correct. A moderate increase in activity may take place without corresponding increase in appetite [7]. Anyway, physical activity must not be regarded as a rapid method for weight reduction. Caloric intake is much easier to regulate than caloric output. Regular physical training must therefore be regarded first and foremost as a valuable supplement to diet in treating obesity.

There is no evidence that a good physical condition protects against infection [14]. Sportsmen are just as exposed to these infections as anybody else, and indeed, some infections have occurred more commonly among sportsmen than among other people. In that respect it may be said that people who suffer from a degree of chronic illness are often in poor physical condition but that almost all of them are trainable. The course and duration of the disease will seldom be influenced by physical training, however.

Evidence is accumulating that exercise has profound benefits for brain function. Positive correlation between physical activity and information processing speed in young and older subjects was reported [3]. Physically fit, aged individuals, identified by self-report of activity level, performed better on measures such as reasoning, working memory, vocabulary and reaction time than their sedentary counterparts [17]. Wu, et al. [16] claim that adult mammalian brain produces new neurons in some parts of brain throughout life. The structural changes associated with exercise are reflected in improvements in synaptic plasticity in rodents that run [4]. We have accumulated evidence that exercise influence brain vasculature. In particular, physical activity increases the proliferation of brain endothelial cells and angiogenesis throughout the brain [2]. Lastly, there is some body of research evidence showing that physical activity can change the function of neurotransmitter systems in the brain [9].

Physical activity and mental health

Good mental health is in the first place the absence of the more severe behavioral disorders that make it impossible or difficult to master the problems of daily existence. The criteria for good mental health are therefore not only the absence of definite mental disorder, social maladaptation and personality disorder. Good health is also the presence of excessive vitality, mental wellbeing and development. Good social adaptation and the actualization of talent and capacities are often also included. It has been objected that the concept of mental health gives the impression of too great separation between physical and mental health. When we use the expression mental health we should therefore underline that physical and mental health are two aspects of the same thing rather than different phenomena. It is difficult to conceive physical suffering without an effect upon the mental condition, and mental disorders are often accompanied by physical changes.

The relationship between physical activity and mental health may be explained in a number of different ways. Since physical training may lead to an alteration in the body image, a more positive appreciation of one's own body, it is reasonable to suppose that the whole self-image can be colored by this and be more in line with what one would wish to be. It is customary to distinguish between situational anxiety, which is anxiety such as is expressed in a certain situation, and free floating anxiety, which is the individuals tendency to react with anxiety to a variety of situations. Several experimental studies [8], [15] indicate that training programs reduce the level of both types of anxiety. Even if some studies have not been able to confirm the relationship found between training and in anxiety, it is concluded that physical activity does have a favorable effect on the level of anxiety. Other experimental study has reported an increase in wellbeing, reduction of tension, better sleeping habits, and less depression [10]. Psychosomatic explanation for the relationship between physical activity and emotional condition postulates that physical activity leads to reduction in physiological activation and reduction in emotional reactivity to strain. This hypothesis suggests a possible relationship between physical activity and psychosomatic disorders [5].

Conclusions

The physiological and psychological effects of physical activity in various forms have been studied extensively in the last decade [2], [3], [16]. It has been shown that the capacity for training of the organism is very great, and that this trainability is preserved in high degree during illness [14]. The consequence is that through physical activity majority of individuals can improve their function-

al condition and therefore their total life situation. Trainability is of course especially great in the young immature individual because of his/her great reserve potential, but it is also considerable in older individuals, because the initial level in the latter is often low [15]. Research results suggest in addition that physical activity directly or indirectly also influence some aspects of brain function and mental health in a favorable direction [17]. The intensity of training and the amount of training necessary to secure a substantial gain in health appears to be becoming gradually clearer [18]. Training beyond this limit will presumably result in relatively modest degree of further health gain. Hence there is hardly any reason to suggest that participation in exercise and sport at the top level is going to yield extra dividends in the form of extremely good health. As regards the question of a more specific preventive effect of physical activity, the circumstances have been less well studied. It seems that such an effect can be obtained for a number of common ailments, such as disorders in the musculo – skeletal, back symptoms, generally poor fitness, and a number of different forms of functional disorder in various organ systems. As regards the more serious diseases, there is now good hope that physical activity will prove to confer on the individual a considerable degree of protection against degenerative illnesses [19], [20], [21]. Apart from this, it would seem that the factors leading to disease, whether known or unknown, congenital or acquired, have such penetrating power that they probably equally affect both trained and untrained individuals. However, convalescence after illness appears to take place faster in well trained individuals [22]. It is still more difficult to pronounce on the question whether physical activity by itself can affect the lifespan in a favorable direction. This question has so far not been answered and many authorities doubt whether on the whole it is possible to make decisive investigations on healthy individuals, because of the complexity and covariation of variables.

A series of questions about the relationship between physical activity and health are however still insufficiently clarified. This is to a large extent due to the lack of standardization and specification of conditions under which the studies are carried out, making it difficult to compare results. This regards for instance the significance for health of training in children, adolescence and elderly. Moreover, the complicated interplay of factors relating physical activity and mental health and epigenetic influence etc. However, it can be asserted with safety that both on theoretical and on experimental ground regular physical activity, training for the population can be recommended with greater and greater certainty and that any objection to such activities are very small in comparison to the health benefits. These recommendations are also in accordance with the principle of responsibility for one's own health. Activation of the inactive will yield the greatest health gain. Further activation of those already active will yield a more limited improvement, if any at all, in the health of population. Physical activity leads to better health. It is a benefit and undoubtedly also of economic

value [23]. It is therefore worthwhile to pursue physical activity, also because of its value in health economies. At the end we can conclude that health should be seen as a benefit in itself, a benefit desirable even if it puts the community to expense. In all other sectors benefits have a price. It is unreasonable to expect that health in addition to everything else should yield a net profit. Our examples indicate nevertheless that physical activity can diminish disease and therefore costs. Finally, we can conclude that pursuance of physical activity is worthwhile in every respect.

References

- [1] Benjamin M. et al. (2006): *Where tendons and ligaments meet bone: attachment sites ('enthuses') in relation to exercise and/or mechanical load*. Journal of Anatomy and Physiology, Apr., 208, 4, pp. 471–490.
- [2] Booth F.W et al. (2012): *Lack of exercise is a major cause of chronic diseases*. Compr Physiol., Apr., 2(2), pp. 1143–1211; <http://dx.doi.org/10.1002/cphy.c110025>.
- [3] Delfien V. et al. (2015): *Relationship of the Perceived Social and Physical Environment with Mental Health-Related Quality of Life in Middle-Aged and Older Adults*. Mediating Effects of Physical Activity, 10(3), e0120475, published online 2015 Mar 23; <http://dx.doi.org/10.1371/journal.pone.0120475>.
- [4] Farmer J. et al. (2004): *Effects of voluntary exercise on synaptic plasticity and gene expression in the dentate gyrus of adult male rats in vivo*. Neuroscience, 124, 1, pp. 71–79.
- [5] Hatta A., Nishihira Y., Hiqashiura T. (2013): *Effects of a single bout of walking on psychophysiologic responses and executive function in elderly adults: a pilot study*. Clin. Interv. Aging, 8, pp. 945–952.
- [6] Howden E.J., et al. (2013): *Effects of Exercise and Lifestyle Intervention on Cardiovascular Function in CKD*. Clin J Am Soc. Nephrol., Sep., 8, 9, pp. 1494–1501.
- [7] Joshua A.B. et al. (2015): *Healthy obesity and objective physical activity*. Am. J. Clin. Nutr., Aug., 102, 2, pp. 268–275.
- [8] Lindsey B.D. et al. (2012): *Exploring exercise as an avenue for the treatment of anxiety disorders*. Expert. Rev. Neurother., Aug., 12, 8, pp. 1011–1022.
- [9] Li Y et al. (2008): *TrkB regulates hippocampal neurogenesis and governs sensitivity to anti-depressive treatment*. Neuron., 59, 3, pp. 399–412.
- [10] Kangas J.L. et al. (2015): *Examining the Moderating Effect of Depressive Symptoms on the Relation Between Exercise and Self-Efficacy During the Initiation of Regular Exercise*. Health Psychol., 34, 5, pp. 556–565.
- [11] Nobrega A.C. et al. (2014): *Neural Regulation of Cardiovascular Response to Exercise: Role of Central Command and Peripheral Afferent*. Biomed Res Int., 478965.

- [12] Pälve S.K. et al. (2014): *Association of Physical Activity in Childhood and Early Adulthood With Carotid Artery Elasticity 21 Years Later: The Cardiovascular Risk in Young Finns Study*. Am. Heart. Assoc. Apr., 3, 2, e000594.
- [13] Roberts Ch.K. et al. (2014): *Metabolic Syndrome and Insulin Resistance: Underlying Causes and Modification by Exercise Training*. Compr Physiol. Author manuscript; available in PMC 2014 Aug 12. Compr. Physiol., Jan., 3, 1, pp. 1–58.
- [14] Silverman M.N., Deuster P.A. (2014): *Biological mechanisms underlying the role of physical fitness in health and resilience*. Interface Focus., Oct., 4, 5, 20140040.
- [15] Spirduso W., Francis K., MacRae P. (2005): *Physical Dimension of Aging*. 2nd Edition, pp. 384; ISBN 139780736033152.
- [16] Sutherland R. et al. (2013): *A cluster randomised trial of a school-based intervention to prevent decline in adolescent physical activity levels: study protocol for the 'Physical Activity 4 Everyone' trial*. BMC Public Health. 13, 57; <http://dx.doi.org/10.1186/1471-2458-13-57>.
- [17] Voss W.M. et al. (2013): *Bridging animal and human models of exercise-induced brain plasticity*. Trend. Cog. Sci., Oct., 17(10), 525–5; <http://dx.doi.org/10.1016/j.tics.2013.08.001>.
- [18] Borde R. et al. (2015): *Dose-Response Relationships of Resistance Training in Healthy Old Adults: A Systematic Review and Meta-Analysis*. Sports Medicine, 45(12), pp. 1693–1720; <http://dx.doi.org/10.1007/s40279-015-0385-9>.
- [19] Panilla G.F., Hillman Ch. (2013): *The Influence of Exercise on Cognitive Abilities*. Compr. Physiol., 1, pp. 403–428; <http://dx.doi.org/10.1002/cphy.c110063>.
- [20] Thijssen H.J. et al. (2009): *Impact of inactivity and exercise on the vasculature in humans*. Eur. J. Appl. Physiol., 108(5), pp. 845–875; <http://dx.doi.org/10.1007/s00421-009-1260-x>.
- [21] Hass L.T. et al. (2012): *Exercise Training and Peripheral Arterial Disease*. Compr. Physiol., 2 (4), pp. 2933–3017; <http://dx.doi.org/10.1002/cphy.c110065>.
- [22] Heran S.B, et al. (2011): *Exercise-based cardiac rehabilitation for coronary heart disease*. Cochrane Database Syst. Rev., 7: CD001800. <http://dx.doi.org/10.1002/14651858>.
- [23] Edwards T.R. et al. (2013): *Public health economics: a systematic review of guidance for the economic evaluation of public health interventions and discussion of key methodological issues*. BMC Public. Health., 13: 1001; <http://dx.doi.org/10.1186/1471-2458-13-1001>.

Aktywność fizyczna a zdrowie

Streszczenie

Zdrowie to stan pełnego fizycznego, umysłowego i społecznego dobrostanu, a nie tylko brak choroby czy kalectwa. Nie jest to coś, co się dostaje, lecz coś, na co trzeba pracować i o co trzeba się starać. Implikuje to konieczność podejmowania aktywnych wysiłków przez pojedynczych ludzi, rodziny i społeczności. W łańcuchu czynników sprawczych i procesów patologicznych prowadzących do choroby, kalectwa i zgonu, jest wiele ogniw, znanych nam i nieznanym. Nasze wysiłki należy skoncentrować na tym punkcie owego łańcucha przyczynowego, w którym istnieją najlepiej rokujące perspektywy zmniejszenia prawdopodobieństwa zapadalności na choroby, zapobiegania kalectwu i zgonom.

Chorobogeny styl życia i czynniki środowiskowe dominują obecnie w naszych statystykach zdrowotności. Materialne warunki życia i filozofia osobista leżą u podstaw powstawania i rozwoju chorób. Pod tym względem, regularna aktywność fizyczna uważana jest za podstawowy składnik stylu życia, będący podstawą idei promowania zdrowia. W artykule omówiono aktywność fizyczną i jej wpływ na zdrowie.

Słowa kluczowe: promocja zdrowia, aktywność fizyczna, edukacja, dobrostan, jakość życia.