Walking in nature

V. Bunc
Faculty of Physical Education and Sports Charles University, Prague, Czech Republic

Abstract
This study summarizes the possibilities of walking in nature as a toll influencing health, physical fitness, body composition and well-being and other psychological variables. Following the intervention program lasting 5 months with an energy content of 1000 kcal per week intensity in seniors, 1500 kcal in middle-aged men and 2000 kcal for children composed of at least 80% walking, pointing to significant changes in physical fitness and body composition parameters. Together with these variables were significantly improved the predispositions for physical and workload. It may be concluded that walking in the range of about 10 000 steps (7 000 in seniors and 12 000 in children) per day is able to remove the movement deficit, which is due to present lifestyle and may be used in majority population for improvement of health predispositions and for improved of physical fitness state.

Key words
walking, nature, movement intervention, physical fitness, body composition, children, adult men, seniors

Introduction

The fundamental problem today is steadily decreasing amount of physical activities regularly carried out, leading to a decline in fitness and subsequent manifestation of many health problems and working. Conversely rapidly increase the psychological stress. The aim of all interventions is a change in sedentary to an active lifestyle.

Physical activity can improve health state and predispositions for working and leisure time activities - active life style in subjects. However, despite these potential health benefits, the majority of nowadays individuals do not exercise regularly (Bond Brill, Perry, Parker 2002).

Important role in the implementation of physical activities play their availability, the location of and the ability to communicate with the surrounding nature (Tully et al. 2005).

Among people who do exercise, walking is the most popular form of physical activity. Walking is a weight-bearing form of aerobic exercise that can be easily integrated into one's daily life and it is frequently recommended as a way to help protect against health problems and low working and leisure capacity (Tully et al. 2005).

Major advantage with walking over running is that it has a lower frequency of injuries and that in a group of patients the probability of exceeding of security level is lower than in running. By application of walking like a group exercise form it is very important that exercised subjects are able to communicate during the exercise, what can contribute to the wellness of these subjects. Walking differs from a running gait in a number of ways. The most obvious is that during walking one leg always stays on the ground while the other is swinging. In running there is typically a ballistic phase where the runner is airborne with both feet in the air (for bipedals) (Biewer 2003; Bunc, Dlouhá 1997; Fenton 2001).

The course of energy cost coefficient c is presented in Figure 1.

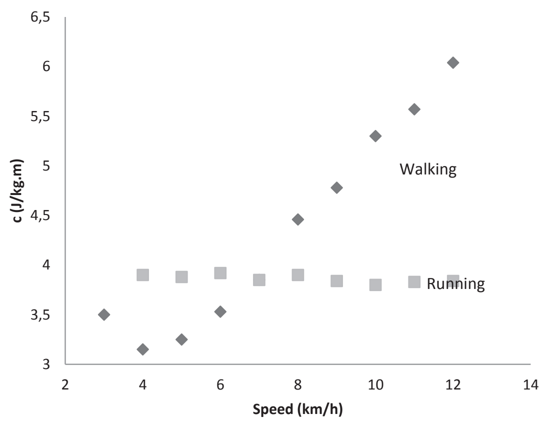

Figure 1 Course of walking and running energy cost coefficient c in dependence on speed of movement.

In the range of intensities lower than 7 $km.h^{-1}$ the dependence of c on speed of walking has a minimum at a ground speed about 4 $km.h^{-1}$, increasing exponentially at speeds slower and at speeds greater than 7 $km.h^{-1}$ the coefficient of walking energy cost increases practically linearly with increasing of moving speed. In the same Figure is presented the coefficient c for running. In the range from 4 to 12 $km.h^{-1}$ this coefficient is practically constant (Bunc, Dlouhá 1997).

Human walking is accomplished with a strategy called the double pendulum. During forward motion, the leg that leaves the ground swings forward from the hip. This sweep is the first pendulum. Then the leg strikes the ground with the heel and rolls through to the toe in a motion described as an inverted pendulum. The motion of the two legs is coordinated so that one foot or the other is always in contact with the ground. The process of walking recovers approximately sixty per cent of the energy used due to pendulum dynamics and ground reaction force (Biewer 2003; Ogilvie et al. 2007; Stephen et al. 2011; Neptune, Sasaki, Kautz 2008).

Another difference concerns the movement of the center of mass of the body. In walking the body "vaults" over the leg on the ground, raising the center of mass to its highest point as the leg passes the vertical, and dropping it to the lowest as the legs are spread apart (Stephen et al. 2011).

Essentially kinetic energy of forward motion is constantly being traded for a rise in potential energy. This is reversed in running where the center of mass is at its lowest as the leg is vertical. This is because the impact of landing from the ballistic phase is absorbed by bending the leg and consequently storing energy in muscles and tendons. In running there is a conversion between kinetic, potential, and elastic energy (Neptune, Sasaki, Kautz 2008).

There is an absolute limit on an individual's speed of walking (without special techniques such as those employed in speed walking) due to the upwards acceleration of the center of mass during a stride - if it's greater than the acceleration due to gravity the person will become airborne as they vault over the leg on the ground. Typically however, animals switch to a run at a lower speed than this due to energy efficiencies (Biewer 2003).

Many people walk as a hobby, and in our post-industrial age it is often enjoyed as one of the best forms of exercise. The types of walking include bushwalking, racewalking, weight-walking, hillwalking, volksmarching, Nordic walking and hiking on long-distance paths (Fenton 2001). Sometimes people prefer to walk indoors using a treadmill. In some countries walking as a hobby is known as hiking (the typical North American term), rambling (a somewhat dated British expression, but remaining in use because it is enshrined in the title of the important Ramblers), or tramping. Hiking is a subtype of walking, generally used to mean walking in nature areas on specially designated routes or trails, as opposed to in urban environments; however, hiking can also refer to any long-distance walk. More obscure terms for walking include "to go by Marrow-bone stage", "to take one's daily constitutional", "to ride Shanks' pony", "to ride Shanks' mare", or "to go by Walker's bus". Among search and rescue responders, those responders who walk (rather than ride, drive, fly, climb, or sit in a communications trailer) often are known as "ground pounders" (Fenton 2001).

Professionals working to increase the number of people walking more usually come from 6 sectors: health, transport, environment, schools, sport & recreation and urban design.

Regular, brisk cycling or walking can improve confidence, stamina, energy, weight control, life expectancy and reduce stress. It can also reduce the risk of coronary heart disease, strokes, diabetes, high blood pressure, bowel cancer and osteoporosis. Modern scientific studies have shown that walking, besides its physical benefits, is also beneficial for the mind — improving memory skills, learning ability, concentration and abstract reasoning, as well as reducing stress and uplifting one's spirits (Haskell et al. 2007).

The health benefits of physical activity are well documented in relation to weight management and the prevention of chronic illnesses, as well as improving mental health and cognitive function (Nelson et al. 2007).

However, our knowledge of the benefits of physical activity is not matched by our
understanding of how to get people active and maintain activity.

There is a need for developing and trialing strategies for non-trained subjects to include physical activity into their lifestyle. These interventions need to be systematic, robust, and longer-term, incorporating different methods of engaging specific demands of intervened population groups (Rafferty et al. 2002).

Many factors influence physical activity behavior, yet there is limited evidence of the effectiveness of strategies to increase physical activity.' This is the case particularly in regard to booster programs, even though the little specific data available on physical activity booster programs are generally positive. Interestingly, lessons may be learned from the obesity treatment area, which has made significant gains in terms of promoting and improving
long-term behavior change (Haskell et al. 2007; Gordon et al. 2010).

The 10 000 steps per day physical activity prescripti-

on that has been suggested to meet
the minimum recommendation for physical activity in adult subjects. In seniors it is necessary to realize daily about 8 000 steps and oppositely in children about 12 000. Despite some research that supports walking regularly and completing 10 000 steps a day is enough activity to produce positive changes in lifestyle and certain aspects of fitness and cardiovascular health, other research has shown limited effectiveness of walking programs and the long term durability of any observed changes has recently been questioned (Choi et al. 2007; LeMasurier, Sidman, Corbin 2003; Schneider et al. 2006).
Walking is a viable form of physical activity that research has shown to be an effective intervention in the aging population, producing both physical and psychosocial benefits. However, there are many barriers to physical activity for the elderly, including safety issues, access, support, and health concerns. Community mall walking programs have the potential to address several of these barriers, particularly safety and social support needs (Ogilvie et al. 2007).

Effects of walking

Recent position statements have re-affirmed the benefits of an active lifestyle (Haskell et al. 2007; Nelson et al. 2007). The current physical activity recommendation for adults, aged between 18–65 years, to promote and maintain health is to accumulate at least 30 minutes of moderately intense physical activity on at least five days of the week. Promoting accumulative, lifestyle physical activity is an ideal approach to combat the high levels of inactivity evident in global populations (Scottisch Executive 2005; Macera et al. 2005).
Brisk walking has been suggested as the mode of physical activity most likely to increase physical activity at a population level (Hillsdon, Thorogood 1996) and is the most commonly reported mode of exercise amongst adults in many populations (Rafferty et al. 2002; Scottisch Executive 2005). It is available to almost all individuals with little risk of injury, is a no cost activity and it can be incorporated into peoples‘ daily routines (Morris, Hardman 1997). Researchers have identified that self determined brisk walking, even in short bouts of 10 minutes, for 30 minutes a day (including simple everyday walking activities such as walking a dog) produce moderate physical activity at the intensity required to achieve health benefits (Ainsworth et al. 200; Murtagh, Boreham, Murphy 2002).
Walking interventions can be effective in reducing body weight, waist and hip circumference, body fat, blood pressure and the cholesterol high density lipoprotein (HDL) ratio (Ainsworth et al. 200; Haines et a. 2007; Kelley, Kelley, Tran 2001; Kelley, Kelley, Tran 2004; 1Miyatake et al. 2003; Murphy et al. 2007; Murtagh, Boreham, Murphy 2002; Swartz et al. 2003) and may be effective in improving mood, affect (Kelley, Kelley, Tran 2001; Murphy et al. 2002; Tully et al. 2007) and quality of life (Fisher, Li 2004). Conversely, some studies have demonstrated that a walking intervention is not sufficient to affect any of these health-related outcomes (Coull et al. 2004; Gilson et al. 2007; Nies, Chruscial, Hepworth 2003; Stanton, Arroll 1996; Tudor et al. 2004). The reasons for such equivocal results are unclear, therefore determining the potential health benefits that can be achieved through walking are crucial to the public health message. One possible cause controversial results could be lack the intensity of load (walking speed), and insufficient duration and frequency of exercise.
Whilst several meta-analytical and systematic reviews exist that examine how best to promote physical activity (Hillsdon et al. 2005; Kahn et al. 2002) there is comparatively limited evidence on the most effective methods to specifically promote walking.
A recent systematic review from Ogilvie and colleagues (Ogilvie et al. 2007) examined the effectiveness of interventions aimed at increasing walking at both an individual and population level. The review concluded that the strongest evidence exists for tailored interventions that are targeted at individuals most motivated to change. The authors suggested that future studies should also attempt to examine whether walking interventions "are sufficiently frequent, intense, or sustained to produce measurable outcomes in anthropometric, physiological, biochemical or clinical outcomes".
A recent systematic review examined the association between pedometer use, physical activity levels and a variety of health related outcomes (Bravata et al. 2007). The authors concluded that pedometer use was significantly associated with increased physical activity levels and reductions in BMI and systolic blood pressure. In 2006 the National Institute for Health and Clinical Excellence (NICE) in the United Kingdom produced a review of pedometer-based intervention studies between 1990 and 2005 (NICE 2006). Due to stringent inclusion criteria, conclusions from this review were drawn from only four studies. Both reviews provide support for the suggestion that pedometers may be useful motivational tools for increasing walking. However, there are several limitations when considering the volu-

me of published studies in this area highlighted by these reviews. Studies were predominantly of short duration (< 12 weeks) and based in the USA with small samples consisting mostly of clinical sub-populations. There is limited evidence regarding their effectiveness in non-clinical samples or in countries other than the USA. Additionally, few studies reported more than one outcome variable of interest.

There is a need for cross-cultural, sufficiently powered randomized controlled trials to further examine the effectiveness of pedometers in a community setting.

In practice, a provider's ability to promote physical activity has been limited by time constraints, lack of training in exercise prescription, concerns over monitoring patient safety, and lack of access to cost-effective resources that help patients remain active. The goal of this study was to assess an effect of intervention program based on walking on physical fitness and body composition in groups without of regular physical training differing in age.

Subjects and methods

The groups of children (139 with normal mass, 95 overweight and 65 obesity – mean age 12.2±2.1 years), 68 middle age men (mean age 45.7±3.6 years), and 53 healthy senior women (68.7±5.0 years) were participated in this study. The research will be performing in subjects that are residing in area of Prague, without objective internal limitation, that participate on physical activity programs of Faculty of Physical Education and Sports Charles University Prague. Before the start of their participation in this study all absolved the medical evaluation together with dynamical assessment of ECG and blood pressure that was realized by physician one week before the start of the program.

Selected anthropometrical and maximal functional variables are collected in Tables 1-3.

Before the start of each movement diagnostics it is necessary to verify the movement ability of the subject that means if the subject is able to realize the movement activity that is assessed. This process could be divided in two parts (Bunc, 1990):

- skills – then means a level of movements skills, that will be decisive for diagnostics evaluation a that are a result of absolved training,
- muscles state (morphological, strength, etc) – these are strongly dependent on genetic predispositions but could be influent by the imposed training.

The maximal functional variables determined on a treadmill with slope of 5% during a progressive walking test until subjective exhaustion. The initial speed on the treadmill was in range of 3-5 $km.h^{-1}$ (in dependence on physical fitness state) and was increased each minute by 1 $km.h^{-1}$. The cardiorespiratory variables were measured in an open system using an on line method by TEEM 100 (Aerosport). All analyzers were checked before and after each test by a calibration gas of known concentration.

Time duration of intervention was 5 months and program was realized during the spring or autum.

The energy output on the level of 1000 kcal (4180 kJ) per week in seniors, 1500 kcal (6270 kJ) in adult and 2000 kcal (8360 kJ) in children were respected by construction of individual moving programs (Astrand, Rodahl 1986).

Age related changes in body composition (BC) have implications for physical function and health. The redistribution and increase of fat and the loss of muscle mass result in substantial decrease in functional capacity. Although BC, as well as the age-related changes in it, has a strong genetic component, it is also influenced by environmental factors. The primary influences are nutrition, disease, and physical activity (Blanchard, Conrad, Harrison 1990).

Clinically, BC is viewed in terms of two compartments: fat and fat-free mass (Blanchard, Conrad, Harrison 1990; Bunc et al. 2000). Fat mass (FM) plus fat-free mass (FFM) that are make of proteins, water, and minerals, equals to the total body mass.

Beginning in middle adulthood, FFM begins to decline gradually both in men and women, primarily due to the wasting of muscle tissue (Blanchard, Conrad, Harrison 1990). Similarly like FFM decreases with age the body cell mass (BCM) in subjects without of systematically physical training. This similarity is confirmed by a high significant positive correlation between these both variables (Bunc et al 2000). The BCM is the sum of oxygen-using, calcium rich, glucose-oxidising cells. This variable may indirectly characterize the ability of human to sustain a mechanical work.

Numerous tools and methodologies have been developed to measure various BC parameters. The bioelectrical impedance analysis (BIA) seems to be one of the most used methods in the field conditions (Roche, Heymsfields, Lohman 1996). Regardless of which instrument is chosen to assess BC, the method is only as good as the measurement technique and prediction or conversion formula applied. The conversion formulas and prediction equations selected use must be restricted to the populations from which they were derived to remain valid (Blanchard, Conrad, Harrison 1990; Bunc et al. 2000; Roche, Heymsfields, Lohman 1996).

One of the basic themes in exercise science research has focused on the relation of exercise on improvement of physical fitness, usually measured as maximal oxygen uptake (VO2max). Physical fitness is a broad concept, encompassing several specific types of fitness including strength, flexibility, and balance (Blair, Connelly 1996). The actual physical fitness state is not only the predisposition of better physical performance but it is the significant basis of their working capacity and in seniors of an independency. When evaluating the influence of physical activity on the human it is important to know its energy requirement (Bunc 1994). A positive influence is exerted only by those physical activities, when during their application a certain minimal threshold is exceeded. The level depends on the purpose for which these activities are performed.

The body cell mass is calculated using the FFM and phase angle between whole impedance vector and resistance α [44]. The extra cellular mass (ECM) is the difference between FFM and BCM - ECM = FFM - BCM. The FFM was calculated according to modified formula of Deurenberg et al. (1992).

Resistance and reactance were measured at four frequencies - 1, 5, 50 and 100 kHz (B.I.A. 2000M, Data Input, Germany) on the right side of the body by tetrapolar electrode configuration in accordance with manufacturer's specification. For the calculation of body fat content were used the prediction equation that were valid in senior women by DEXA method.

The energy demand of physical exercise was collected by Caltrac measurement together with assessment of energy cost of exercise from general relationship between the exercise intensity and energy that he or she needs for cover of this activity (Bunc 1994). The differences between both methods were lower than 12%.

According to our measurements in children (n=320), adult men (n=154), adult women (n=86), and senior women (n=106) the general dependence of oxygen consumption on walking speed on flat surface in range of intensities 3-9 $km.h^{-1}$ was established in the form

$$\mathbf{VO2.kg^{-1}(ml.kg^{-1}.min^{-1}) = 5.7488 * v\ (km.h^{-1}) - 6.0561}$$

$$\mathbf{r=0.872,\ p<0.005,\ SEE=1.49\ ml.kg^{-1}.min^{-1},\ TEE = 1.74\ ml.kg^{-1}.min^{-1}}$$

For calculation of energy cost from oxygen uptake was used mean energy equivalent for oxygen 4.83 $kcal.min.l^{-1}$ (20.2 kJ. $min.l^{-1}$), neglecting the contribution of protein (about 15%) to the total metabolism (Astrand, Rodahl 1986).

Results and discussion

All participants were able to realize the recommended content of intervention. The minimal volume of walking ranged from 82% in children to 88% in seniors.

The time spent at the exercise intensity in range of 80-90 %HRmax and in weekly volume ranged between 90-250 min. Walking time ranged between 80 and 220 min.

The time spent for other form of physical activities ranged between 10 and 30 min. Rest exercise was realized like home gymnastics, swimming, jogging or cycling.

The daily mean steps before intervention ranged from 5 800±280 in seniors to 9 200±430 in children. The mean volume of daily steps during intervention ranged from 8 700±310 $steps.day^{-1}$ in seniors to 12 250±408 $steps.day^{-1}$ in children with normal body mass.

Mean values of selected anthropometrical and functional variables are presented in Tables 1-4.The initially values of BC and aerobic fitness were practically the same like are the Czech population standards of this age. After the 5 months of aerobic training, both values of aerobic fitness and BC were significantly better than Czech population standards [46].

The energy output of realised moving activities in seniors ranged from 650 kcal (2675 kJ) to 1780 kcal (7740 kJ) (mean 950±230 kcal - 3970±960 kJ). The energy output in adults ranged from 1020 kcal (4264 kJ) to 2250 kcal (9045 kJ) (mean 1500±290 kcal - 6270±1212 kJ).

Results of the intervention with this energy content were collected in Tables 1-2.

Table 1 Selected anthropometric and functional variables collected before and after intervention in adults (n=68).

	Before	After
BH (cm)	175.3±2.6	175.4±2.5
BH (%)	100	100.0±0.1
BM (kg)	79.1±7.9	75.6±7.8*
BM (%)	100	95.6±4.6*
FFM (kg)	64.0±3.8	65.4±6.7*
FFM (%)	100	102.0±5.2*
BF_{abs} (%)	19.1±3.1	15.9±2.8**
BF_{rel} (%)	100	83.2±3.1**
BCM (kg)	35.2±3.7	37.0±2.8*
BCM (%)	100	105.1±2.7**
ECM/BCM	0.82±0.03	0.78±0.02**
ECM/BCM (%)	100	95.2±3.2**
HR_{max} ($b.min^{-1}$)	178±7	176±6
$VO_{2max}.kg^{-1}$ (ml)	33.1±5.3	38.7±4.8**
$VO_{2max}.kg^{-1}$ (%)	100	117.0±3.3**
v_{max} (5%) ($km.h^{-1}$)	6.8±1.1	7.8±0.9**
v_{max} (5%) (%)	100	115.0±1.5**

* p<0,05,
** p<0,01

Table 2 Selected anthropometric and functional variables collected before and after intervention in seniors (n=53).

	Before	After
BH (cm)	160.3±2.8	160.3±2.7
BH (%)	100	100.0±0.1
BM (kg)	69.9±7.9	70.4±7.8
BM (%)	100	100.7±5.9
FFM (kg)	43.7±6.8	45.9±6.7*
FFM (%)	100	05.0±5.2*
Fat_{abs} (%)	37.5±5.1	36.9±4.8
Fat_{rel} (%)	100	98.4±3.9
BCM (kg)	22.8±5.0	25.1±4.8**
BCM (%)	100	110.0±2.7**
ECM/BCM	0.92±0.03	0.82±0.02**
ECM/BCM (%)	100	89.2±3.6**
HR ($b.min^{-1}$)	134±6	133±5
$VO_2.kg^{-1}$ (ml)	17.5±3.0	19.0±3.2**
$VO_2.kg^{-1}$ (%)	100	108.6±3.7**
$\%VO_{2max}.kg^{-1}$ (%)	67.4±3.2	67.8±3.0**
v_{max} (5%) ($km.h^{-1}$)	4.4±3.1	4.7±3.4**
v_{max} (5%) (%)	100	106.8±3.3
$\%v_{max}$	73.3±2.9	72.3±3.0

Majority of followed variables were after an intervention better than on the start of evaluation.
In children we assess the effect of walking intervention in subjects differing in body mass state. Movement program in children with normal body mass – energy content ranged from 1360 kcal (5685 kJ) to 2620 kcal (10952 kJ) (mean 1980±310 kcal - 8276±1296 kJ).
In overweight children – energy content ranged from 1650 kcal (6897 kJ) to 2310 kcal (9656 kJ) (mean 1920±230 kcal - 8026±960 kJ), and in children with obesity – energy content ranged from 1940 kcal (8109 kJ) to 2550 kcal (9045 kJ) (mean 2260±290 kcal - 9447±1212 kJ).
Results of these interventions are presented in Tables 3 and 4.

Table 3 Selected anthropometric variables collected before and after an intervention inchildren differing in body mass state.

	Before	After
n=139		
BH (cm)	150.8±2.0	153.4±2.2
BH (%)	100	153.4±2.2
BM (kg) (N)	44.0±3.8	45.4±3.7*
BM (%)	100	103.2±5.2*
BF_{abs} (%)	19.7±3.9	17.0±3.0**
BF_{rel} (%)	100	86.3±3.6**
n=95		
BH (cm)	151.6±2.2	154.1±2.4
BH (%)	100	101.6±2.2
BM (kg) (OV)	52.6±3.0	48.4±2.3**
BM (%)	100	92.1±2.0**
BF_{abs} (%)	24.6±3.1	20.8±2.5**
BF_{rel} (%)	100	84.6±2.4**
n=65		
BH (cm)	152.1±2.1	155.3±2.3
BH (%)	100	102.0±1.8
BM (kg) (OB)	63.2±3.6	54.3±2.8**
BM (%)	100	83.6±2.7**
BF_{abs} (%)	28.3±3.1	23.9±2.9**
BF_{rel} (%)	100	84.4±3.1**

* p<0.05,
** p<0.01,
N – normal body mass,
OV – overweight,
OB – obesity

Table 4 Selected anthropometric variables collected before and after an intervention in children differing in body mass state.

	Before	After
n=139		
v_{max} (km/h) (N)	12.5±1.8	13.9±1.7*
v_{max} (%)	100	111.2±4.2**
VO_{2max}/kg (ml)	44.6±3.9	51.2±3.0**
VO_{2max}/kg (%)	100	114.8±3.6**
n=95		
v_{max} (km/h) (OV)	11.8±1.1	12.8±0.9*
v_{max} (%)	100	108.5±0.9*
VO_{2max}/kg (ml)	33.1±5.3	38.7±4.8**
VO_{2max}/kg (%)	100	116.9±1.5**
n=65		
v_{max} (km/h) (OB)	9.8±0.3	10.4±0.4*
v_{max} (%)	100	106.1±2.2*
VO_{2max}/kg (ml)	24.5±3.2	27.7±3.3**
VO_{2max}/kg (%)	100	113.1±3.6**

* $p<0.05$, ** $p<0.01$,
N – normal body mass,
OV – overweight,
OB – obesity

The changes of majority variables are in relative description non-dependent on body mass state, it means that the walking program is able to realize practically the same changes in BC and physical fitness state. Of course the values that were recalculated on body mass were worse in subjects with higher body mass.

The proportion between the ECM and BCM ratio may be used to identify fluid imbalance or malnutrition and/or to assess the predispositions for muscular work. The term malnutrition refers to the loss of structural body components, which is most accurately reflected by the BCM and an increase of the ECM (Bunc et al. 2000).

The using of ECM/BCM for evaluation of physical exercise predispositions was confirmed by the significant dependence of VO2max on this variable. The relationship between VO2max and physical performance was often presented in literature (e.g. Bunc 1990). In our group of subjects this dependence was significant too (ranged from $r=0.792$, $p<0.01$ in seniors to $r=0.720$, $p<0.01$ in children). In practice this coefficient could be used like one of important criterion of exercise program efficiency.

The significant positive ECM/BCM dependence on age could be used for assessment of actual development state – biological age in seniors. In actual case we compare real value of ECM/BCM with value that was calculated according to general relationship that is true for senior women.

In normal subjects of middle age, ECM/BCM ratios are recorded between 0.75 and 1.00. Deviations from such figures toward higher values are due either to the erosion of BCM (catabolism) or to fluid expansion in extracellular spaces (edema). In the case of dehydration, we can observe the opposite phenomenon where the ECM/BCM ration is reduced (Bunc et al. 2000). Because the diet of followed subject was practically without significant alterations during whole 6 months, the significant increase in both FFM and BCM may be probably caused by imposed training program.

The changes in VO2max induced by endurance walking program are practically consistent with those found by Proper et al (2003), who found in group of senior men and women of similar age 14 % increase in aerobic fitness, and significant increase in FFM and significant decrease in BF and total body mass. These results were confirmed by our data but the changes in BC variables were not so high.

There is evidence to show that the magnitude of the increase in VO2max is dependent on total energy expenditure of exercise, and thus on frequency, and duration of exercise as a number of previous investigations have shown improvement to be in direct proportion to the number of weekly sessions (Astrand, Rodahl 1986; proper et al. 2003). According to the results of previous studies, VO2max as measured either in laboratory or in field has generally improved during the first months of conscription among non-trained subjects (Blair, Connelly 2005).

The minimum training energy expenditure required to maintain an elevated VO2max has not been clearly established. For example the most recent ACSM prescription guidelines (Haskell et al 2007) recommended minimal energy expenditure of 300 kcal per exercise session performed three days a week or 200 kcal per exercise session performed four days per week.

Adequate energy output has its effect both in the presence and in the absence of other influences, and the beneficial relationship continues with advancing age.

Physical activities that are based on walking can be implemented without having to visit special sports facilities and often expensive equipment. A major advantage is that it can be implemented in virtually any weather at the time that acceptable by the in-

dividual. Walking can be realized both as an individual activity as a group activity (Fujinami 2010). It is essential also that walking can be realized even within the family or as a joint activity of children of parents and grandparents. It should also be noted that walking at speeds higher than 6 km/h is already significant burden on the body and therefore it is necessary that intensive intervention programs before the individual was medically examined.
The condition required daily volume of physical activity - 10 000 steps - it can handle the full workload. Large margin today is the use of walking as a means of transfer in fulfilling everyday tasks such as working leisure time activities - regeneration. Another success is the regularity (at least three times a week, at least 30 minutes and more) is preferable 10 to 20 minutes daily.
In conclusion walking in energy expenditure ranged from 1000 kcal in seniors to 2000 kcal in children per week may significantly improve the physical fitness, body composition, and motor performance (speed of running) in non-trained groups of subject differing in age.

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