

SECTION – FUNDAMENTAL AND APPLIED KINESIOLOGY

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SLOW JOGGING - A MULTI-DIMENSIONAL APPROACH TO PHYSICAL ACTIVITY IN THE HEALTH CONVENTION**Tanaka Hiroaki¹, Magdalena Jackowska¹****Authors' contribution:**

- A. Study design/planning
- B. Data collection/entry
- C. Data analysis/statistics
- D. Data interpretation
- E. Preparation of manuscript
- F. Literature analysis/search
- G. Funds collection

¹ Fukuoka University Institute for Physical Activity, Fukuoka, Japan**Keywords:** slow jogging, lactate threshold, risk factors of cardiovascular diseases, weight loss, health, PGC-1 α , aerobic capacity, sarcopenia**Abstract:**

Aim. Presenting the benefits of easy and accessible slow jogging, low-intensity running, in reducing cardiovascular risk factors, preventing sarcopenia, improving aerobic fitness, but also improving athletes' performance.

Materials and methods. The work is of review nature. A comparison has been summarised regarding a review of research was carried out, which justifies the benefits of using low- and moderate-intensity runs for some civilization diseases. The assumption is that slow jogging does not dictate a constant speed, but it is intuitive to switch from walking to running at an average speed of 6-7 km/h (preferred transition speed, PTS). In view of the above, slow jogging was defined as a jog at a slower speed than PTS for amateurs (beginners) and running at a lower speed than at the lactate threshold in athletes.

Results. The energy expenditure of the run is twice as high as the energy expenditure of walking at the same speed and the same degree of perceptible effort, making slow jogging one of the best and easily available methods for use in weight-loss programmes. Slow jogging at the lactate threshold level also reduces the risk of cardiovascular disease and improves overall physical fitness. For athletes, it can be a contactless method for regenerating the body after intense exercise and improving results due to fat loss and improving mitochondrial functions. During the weekly programme of health tourism, based on slow jogging training, a reduction in body fat by 3% of body mass was observed, and in athletes, 3% improvement was noted.

Conclusions. Jogging has been a daily human activity since the dawn of time, until the development of motorisation meant that it ceased to be needed. In parallel, society began to gain weight and decline in health due to reduced physical activity and poor nutrition. Slow jogging can contribute to a renaissance of physical activity and a healthier society.

Introduction

Beginning with the research by Morris et al. conducted in 1953 [1], many epidemiological studies have confirmed that lack of physical activity is the cause of cardiovascular disease. Today's society focuses on a comfortable lifestyle and, as a consequence, often gives up walking in favour of cars or public transportation. From year to year, people are becoming less active, while walking is often publicly recommended for improving health. However, even increasing the walking dose will not fully prevent cardiovascular risk factors, as described in a systematic review of intervention studies [2].

Walking and running are basic manner of movement for both man and animals. Walking is preferred for slower movement, while running - instinctively - for moving faster. Running or jogging were the main form of physical exercise for our ancestors, not only in the era of hunters and gatherers, but also in the second half of the twentieth century in Western countries. The main reason for the increase in cardiovascular disease is change in habit, excluding running in everyday life.

The purpose of this work was to review literature on the benefits of easy and accessible slow jogging in reducing cardiovascular risk factors, preventing sarcopenia, improving aerobic fitness, but also improving athletes' performance.

Terminology

The automatic transition from walking to running with increasing speed usually takes place within a narrow range between about 6-7 km/h [3-4]. The preferred moment of transition from march to run (Preferred Transition Speed - PTS) corresponds to approx. 6-7 Mets. At the same time, the maximal oxygen uptake per minute of an average sitting man is 25 ml/kg/min (equivalent to 7.1 Mets), which means that today, for many people, jogging has become vigorous physical effort [5]. In light of these observations, slow jogging has been defined in amateurs as a comfortable walking pace [6].

Both walking and running are innate skills for us and the difference in running technique between people with a sedentary and active lifestyle is only 5-7%. This means that each of us, even without special preparation, knows how to run properly. In everyday life, we all sometimes run - whether on the road at changing lights, or catching a departing bus.

Slow running is referred to as jogging, but many people say that they do not like jogging. The question is why? Their answer is that it is tiring.

At a low intensity of movement, walking is more economical, while at a higher speed – running is. This change occurs at a speed of about 8 km/h [7]. Interestingly enough, PTS is 6-7 km/h, thus, on average, a transition from walking to running at a speed at which walking is still more economical.

For a typical 65-year-old sitting man, the predicted running speed at the lactate threshold is lower than the average walking pace. If he wanted to train at 80% VO_{2max} , his running speed would correspond to the average walking speed. Even for younger men with a sedentary lifestyle, the speed of running at the lactate threshold is the speed of walking. Participants of the experiment were asked to run with a smile, at a conversational pace and RPE (Rating of Perceived Exertion) within the range of 10-12 (mild effort) for 1 min. They ran at a speed corresponding to their lactate threshold or slightly faster, except for athletes (unpublished research from Fukuoka University on a 343-participant group preparing for the Honolulu Marathon).

Slow jogging for fat loss

All daytime physical activity is key for weight loss. The energy expenditure for walking at moderate speeds is about 0.5 kcal/kg/km. On the other hand, running increases this value almost two-fold, regardless of speed [7]. For example, for a man weighing 80 kg, a 4-kilometer walk causes a loss of about 160 kcal. Therefore, a change from walking to jogging over the same distance causes a loss of as much as 360 kcal.

The preferred transition from walking to running is at a speed of 7 km/h, which corresponds to about 7 Mets. For people with low activity levels and a VO_{2max} below 10 Mets, jogging can be exhausting.

The results of research obtained by Margaria et al. [7] were confirmed in the study by Kitajima Y. et al. [8], also for lower running speeds - slow jogging within the range of 3~5 km/h proved to lead to a constant energy expenditure per kilo and kilometre. Interestingly, the RPE value for slow jogging turned out to be close to walking at the same speed - despite a two-fold difference in energy expenditure (Fig. 1). This means that even inactive people can practice slow jogging with a load comparable to walking, and slow jogging is a form of movement conducive to effective weight loss [8].

Slow jogging for the improvement of aerobic fitness (VO_{2max}) and decreasing the risk of circulatory system diseases

The effectiveness of aerobic exercise depends on the intensity of the effort. The peroxisome proliferating receptor gamma 1α co-activator (PGC- 1α) is not only an activator of mitochondrial biogenesis, which promotes the improvement of aerobic capacity, but also a suppressor of inflammatory cytokines encouraging cardiovascular disease and other chronic ailments. Thus, increased PGC- 1α expression may be a key factor in preventing heart disease, various cancers and sarcopenia [9]. It has been observed that PGC- 1α increases during exercise at lactate threshold level or above it, but not below [10, 11]. The effectiveness of the 40×1 min slow jogging model was also confirmed in intervals at the lactate threshold level with 30-second walking intervals to increase PGC- 1α [12]. Physical effort at the lactate threshold level is effective in improving aerobic fitness and lowering blood pressure [13,14], as well as improving HDL cholesterol (HDL-C) [15], insulin resistance and lowering blood glucose [16]. Moderate efforts at 50% VO_{2max} , very close to the lactate threshold, neither too moderate nor too vigorous, cause vasodilatation [17].

Slow jogging prevents sarcopenia

Age-related skeletal muscle atrophy – sarcopenia, and worsening of basal metabolic rate, are obvious causes of obesity. The basis of therapy is both diet and exercise, but they are not able to prevent the worsening of metabolism associated with sarcopenia. It is therefore difficult to prevent recurring weight gain.

It is worth mentioning here that skeletal muscle atrophy does not occur evenly, but is dependent on the area of the body. Abe et al. [18] conducted a study on changes in muscle thickness with age using ultrasound and showed

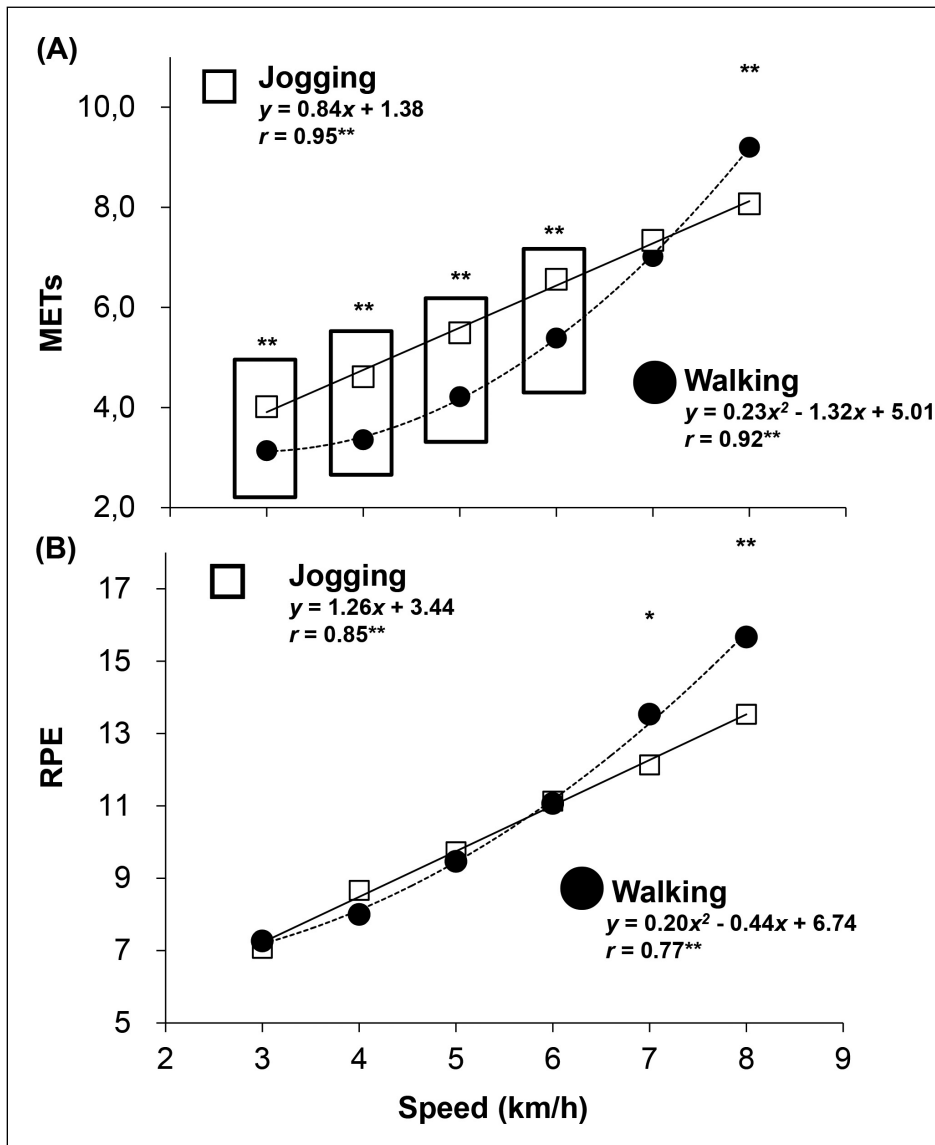


Fig. 1. MET and RPE intensity at different running and walking speeds [8]

that the muscles of the posterior thigh group, quadriceps femoris and abdominal muscles (Fig. 2), as well as the gluteal, the dorsal and larger lumbar muscles, become reduced. The cause is not fully known, but the authors suggest that atrophy is associated with not using these muscles. These muscle groups are primarily used for running and walking up and down stairs, but they are not necessary for moving on flat ground. In Fig. 3, a comparison is shown regarding the electroactivity of the vastus intermedius muscle while walking and jogging on electromyography on the basis of research by Gozendam and Hof [19]. With walking, even at a fast pace, muscle activity is much lower than in the case of jogging and traditional gait - it is only half the value obtained during jogging. It is also known that skeletal muscles are subjected to atrophy if not used.

However, if they are used in a moderate way, their volume persists or increases. Running and walking up and down stairs utilizes the largest muscle groups and helps prevent muscle atrophy, while maintaining a slim figure.

A randomised experiment was conducted involving diet therapy and the application of physical exercise among persons who were affected by metabolic syndrome and suffering from hyperlipidemia [20]. In the group with the diet applied, the dosage of 20 kcal per 1 kilogram of ideal body mass was implemented, and the exercising group used a bench stepper, a stationary bike and slow jogging at an intensity of the lactate threshold lasting 20 minutes each, 3 times a week. It was also recommended to exercise at home so that the total exercise time during the week

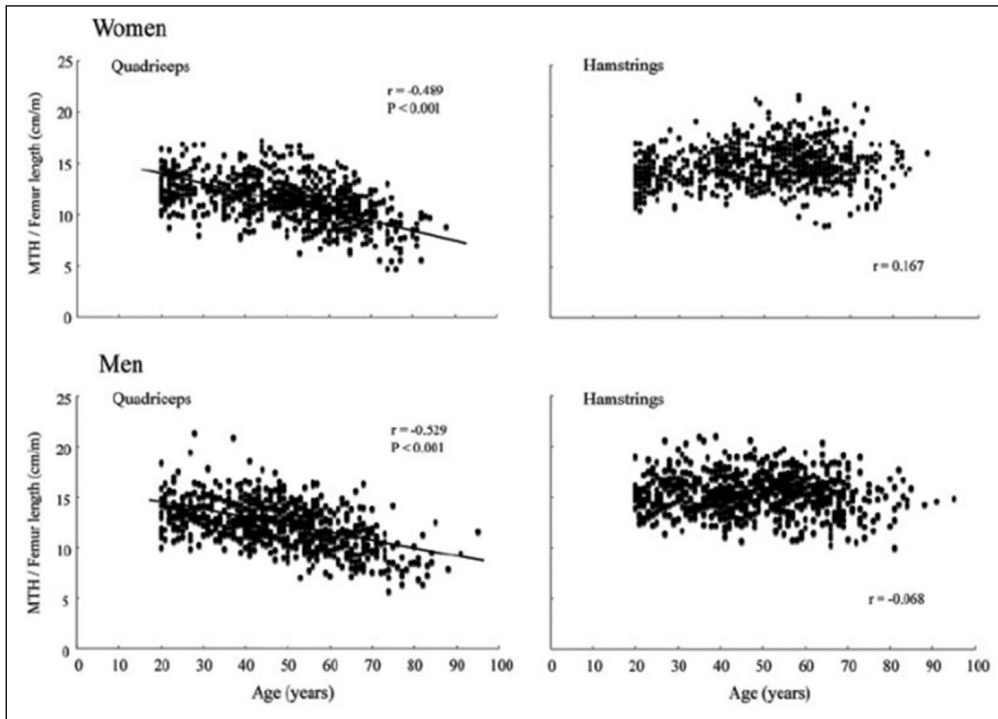


Fig. 2. The relationship between age and the thickness of the quadriceps femoris and the posterior thigh muscles [18].

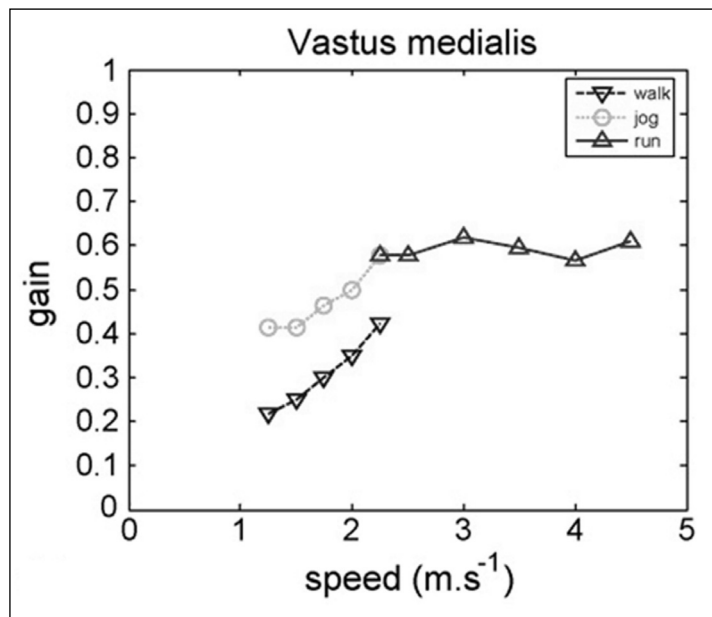


Fig. 3. Activity of the vastus medialis muscle at different walking and running speeds visible in electromyographic examination [19].

was 300 minutes. The programme lasted 12 months. Comparable improvements in body mass, visceral fat and glucose metabolism were observed. Naturally, the VO_2 peak level also increased in the training group. While a significant increase was also noted in this group with regard to concentration of HDL-C (Fig. 4).

The cross-section of the thigh in both groups deserves special interest. In the group with the applied diet, a significant reduction in volume was observed, and in the group exercising – its enlargement was noted. This means that the effect of slow jogging training is not limited to weight loss, but it also prevents muscle loss often

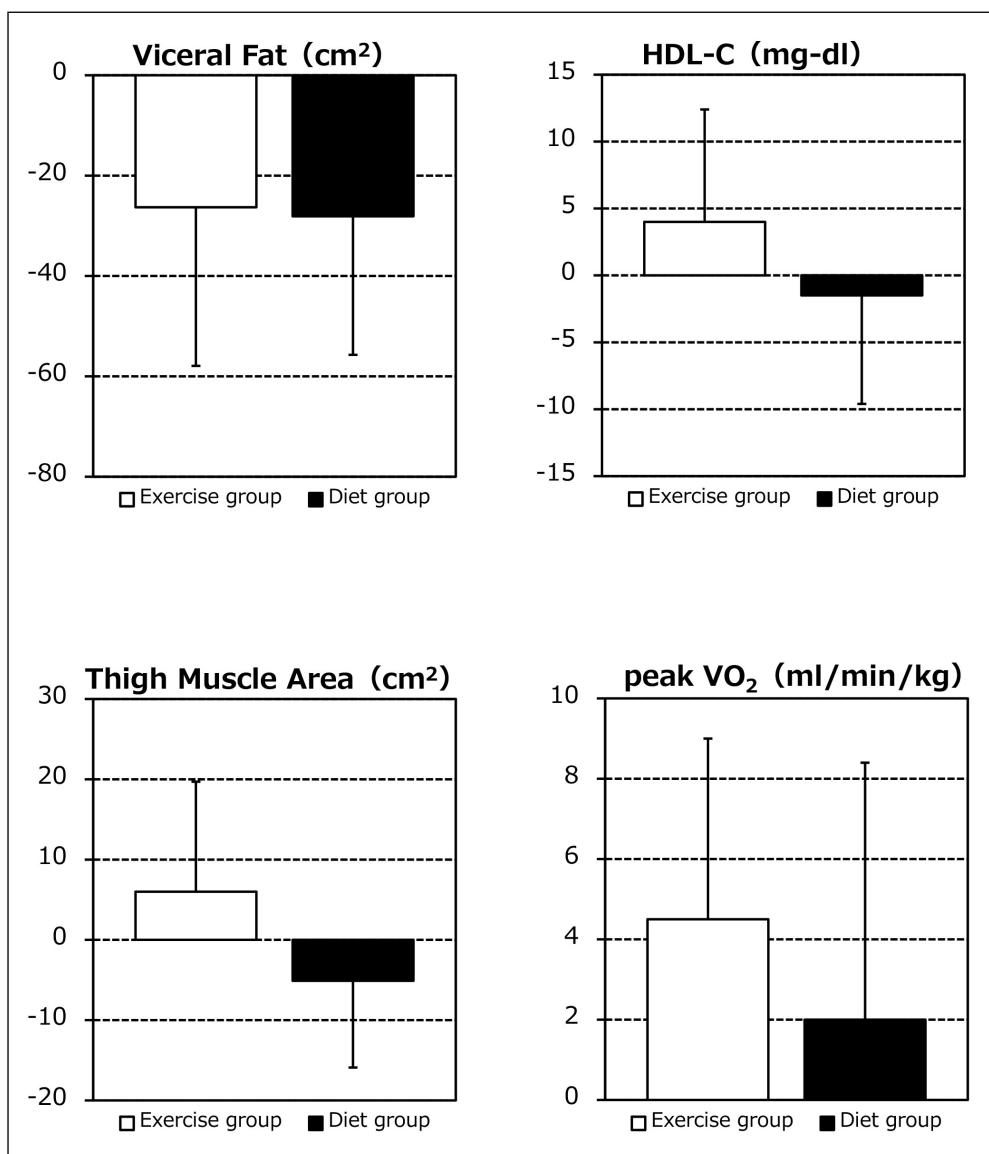


Fig. 4. Changes in visceral fat, HDL, thigh muscle cross-section and peak VO₂ among patients suffering from metabolic syndrome and hyperlipidemia, divided into exercise and diet groups [20]

accompanied by a decrease in total weight loss. Moreover - the muscles become larger and a body resistant to the “yo-yo effect” is shaped. Thigh muscle enlargement was observed in the group of older people practicing slow jogging [21].

Improvement of sports results

Improvement in endurance sports results is possible due to three main factors: weight loss, improvement of skills and improvement in aerobic fitness. Slow jogging is enough for the first two to occur, and running at the lactate threshold level is effective in improving aerobic fitness.

The final result consists of the ratio of work to strength, therefore, weight loss without loss of strength leads to improved results. For example, the results of weight loss in elite athletes were estimated - with a body weight of 70 kg and a result of 10 s per 100 meters, a loss of 3% of body mass (fat tissue alone) means an improvement of up to 9.81 s.

If a similar percentage of body mass is lost by 66-kg athlete running a marathon in 2 h 9 min, his/her result will improve to 2 h 5 min. This is an estimate assuming weight loss without losing strength. It was also mentioned that slow jogging is an effective way to reduce body mass. The combination of food restrictions and slow jogging make it possible to lose such a body mass in a week [22].

In amateur studies, the aim of the diet was body mass $\times 22 \times 20$ kcal/kg was considered as the dietary target. To reduce 3% of body mass in a week, a negative daily energy balance of 2,000 kcal is required. There are limits to the possibility of expending energy by increasing the amount of physical effort, which is especially true in the case of overweight individuals [22].

DLW (Doubly Labeled Water) measurements of energy expenditure in athletes indicates rigorous training exceeding the energy expenditure of 4,000 kcal per day. Even for obese individuals, an amount of activity comparable to long distance runners or professional footballers is necessary. Otherwise, even with a 1,200 kcal diet, a 3% weight loss is not possible.

The reduction of food intake primarily applies to breakfast and lunch, while dinner does not differ from the standard - its time, even consumed late, did not matter. Alcohol consumption is even allowed so as not to increase stress. Satisfaction is increased by making dinner the main meal, hunger is reduced the next morning. It is generally believed that late meals promote weight gain. However, many reports confirm that there is no relationship between the habit of late dinners and being overweight.

In a similar study conducted in a metabolic chamber, Sato et al. [23] compared all-day energy expenditure when consuming dinner at 7 p.m. and 10:30 p.m. - no differences were noted between meal times. In an experiment by Sagayama et al. [22], the protein content in the diet was low and amounted to $0.45 \text{ g kg}^{-1} \text{ d}^{-1}$ of body mass. However, it is known from Leida's research that with dietary meals, a beneficial effect is promoted by a protein content in food of $1.2 \sim 1.8 \text{ g kg}^{-1} \text{ d}^{-1}$ [24] for maintaining lean body mass, meal satisfaction and the thermal effect. Accordingly, the amount of protein intake was set to $\sim 1.5 \text{ g kg}^{-1} \text{ d}^{-1}$.

In a group of 34 middle-aged and senior individuals who wanted to lose weight, the level of satisfaction with meals was 90.8% on a scale where 0 means dissatisfaction and 10 means complete satisfaction. Exercises consisted of 40 repetitions of 1-minute slow jogging sections interspersed with 30-second marching sections. They were held before meals, during the day and after dinner, participants took part in sports-related entertainment, tourism and agrotourism [22].

The total energy expenditure was calculated using the DLW and it averaged 3,424 kcal/day. This exceeds the energy expenditure of swimmers or the female synchronized swimming group of university teams and long-distance runners.

The rating concerning exercises is 70% on a 10-point scale of difficulty, where 0 means extremely difficult while 10 means - appropriate. Despite the experienced muscle pain, the participants managed to perform the exercises. As a result, lean body mass was maintained and body weight was reduced by an average of 3.2%. Blood pressure, glucose, triglycerides, LDL-C and HDL-C improved. In a group of 5 long-distance runners, during the weekly weight reduction programme, additional measurements were taken for the distance of 5,000 m before and after the training programme. The assumptions of this training included meals with a total calorie content of 1,200 kcal per day and 2 hours of slow jogging as an addition to regular training. The result was an average reduction of 1.9 kg in fat mass. The results of the 5,000-m run showed that one runner did not change his result, while four improved - including two who improved their personal record [22].

An example of implementing a proper diet and the slow jogging technique is the author of this work, Professor Tanaka. At 46, he was overweight and ran a marathon in 3 hours 30 minutes. He hypothesized that a reduction of 10 kg body mass would allow him to reduce his time in the marathon to less than 3 hours. For 3 months, he reduced his daily calorie intake by 300-400 kcal and ran 5-7 km at a slow jogging pace. He lost weight and according to the hypothesis, he ran a marathon in 2 h 55 minutes. He then started improving his running skills. He started running, landing on the heel, so he improved his technique so as to land on the metatarsus, alike short-distance competitors. He only trained slow jogging style. He improved his results and at the age of 50, he set a new life record of 2 h 38 min 48 s. Since then, he has been slow jogging all the time. At the age of 70, his VO_2max has decreased, but is comparable to the average results for 20-year-olds.

Conclusions

Slow jogging is a type of aerobic exercise that can be recommended for anyone. It will reduce the risk factors for cardiovascular disease, have a protective effect against excessive fat accumulation and, at the same time, noticeably help prevent a decrease in age-related aerobic and muscle mass loss. What is more, it improves endurance efficiency. It also confirms the theory of "Born to Run" by Bramble and Lieberman [25]. Slow jogging can contribute to the renaissance of physical activity and a healthier society.

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Author for correspondence:

Magdalena Jackowska

E-mail: jackowska.magda@gmail.com

ORCID: 0000-0002-7651-2251

