

Nordic Walking – a new form of exercise in rehabilitation

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walking training, physical activity, cardiac rehabilitation

Abstract

Nordic Walking (NW) has become a popular form of physical activity. NW is a form of outdoor physical activity based on marching with use of poles adapted from cross-country skiing. The main goal of using the poles is to involve muscles, which are not used during normal walking. This enables performing high intensity exercises with a relatively low level of perceived exertion. The history, methodology and technique of Nordic Walking were presented in this paper. Moreover, possible role of Nordic Walking in physical rehabilitation, in particular in early cardiac rehabilitation, was discussed. This paper is based on the available data from the literature and on our own experience concerning the application of Nordic Walking in rehabilitation of patients early after a myocardial infarction. This study was performed in patients admitted to the Centre of Cardiac Rehabilitation in Kiekrz. NW is added as an additional training to standard rehabilitation program comprising ergometer endurance training and callisthenics. The literature review focused mainly on the usefulness of Nordic Walking in rehabilitation of various groups of patients, such as the elderly, patients with pain, and patients with neurological or cardiovascular disorders. The available evidence suggests that Nordic Walking is a natural and safe, yet intensive, form of physical activity that can be widely used in physical rehabilitation.

Słowa kluczowe

trening marszowy, aktywność fizyczna, rehabilitacja kardiologiczna

Streszczenie

W niniejszej pracy przedstawiono dostępną wiedzę o historii, metodyce i technice, coraz bardziej popularnej formy ćwiczeń ruchowych, znanych jako Nordic Walking (NW). NW jest formą aktywności ruchowej w terenie, której głównym elementem jest marsz., przy wykorzystaniu kijków zaadaptowanych z narciarstwa biegowego. Głównym celem używania kijków jest zaangażowanie mięśni nieużywanych podczas zwykłego marszu, przy zachowaniu wysokiej intensywności ćwiczeń i niskiego, subiektywnie odczuwanego poziomu zmęczenia. Zwrócono uwagę na możliwość zastosowania tej formy aktywności w rehabilitacji ruchowej – w tym wczesnej rehabilitacji kardiologicznej. W pracy wykorzystano informacje zawarte w dostępnej literaturze, a także doświadczenie własne z badań prowadzonych w tej dziedzinie, u pacjentów we wczesnym okresie po zawale mięśnia sercowego. Badania te są wykonywane u pacjentów Ośrodka Rehabilitacji Kardiologicznej w Kiekrzu. NW jest włączany, jako dodatkowy trening, w standardowy program rehabilitacji obejmujący ćwiczenia ogólnousprawniające i trening wytrzymałościowy na cykloergometrze. W przeglądzie piśmiennictwa skupiono się głównie na zastosowaniu Nordic Walking w rehabilitacji. Badania dotyczyły osób starszych, a także pacjentów z zespołami bólowymi, chorobami układu nerwowego i układu krążenia. Wyniki wskazują, że Nordic Walking to naturalna, bezpieczna a jednocześnie intensywna forma ruchu. Może być stosowana w różnych obszarach rehabilitacji.

Introduction

It has been known for many years that regular physical activity is one of the most important and independent factors reducing the risk of and even preventing occurrence of many, especially cardiovascular, diseases. Human habitual physical activity comprises occupation-related activity, including activities associated with commuting, leisure activities, i.e. sports and recreation, as well as household activities. Walking is of especial importance, as it is the most frequently performed activity of daily life and it is difficult to find studies pertaining to the assessment of physical activity level that would not consider this form of motion^{1,2,3,4,5,6,7}. In some studies, it was demonstrated that the frequency of assuming the action of walking and the rate of walking are in reverse proportion to the incidence and morbidity due to cardiovascular causes and some of neoplastic diseases^{7,8}.

Walking, an activity seemingly easy to perform and non-requiring mere concentration, is, therefore, an important part of every-day life potentially affecting health. Moreover, it is a frequently recommended and safe form of activity in programs of patient rehabilitation, e.g. in cardiovascular rehabilitation^{9,10}. However, for walking – to be considered a form of therapy or an effective tool of rehabilitation, certain conditions must be met. Walking training should be performed regularly, be characterised by a certain health-beneficial intensity level, be safe and pleasurable while inducing possibly highest achievable energetic expenditure. For some people, namely, walking training is a tiresome marching in a factory hall, for others – a walk in a shopping centre, or sporadic trips to the forest in case of some other people. Health-supporting significance of these activities is, however, difficult to verify. Is there then any form of physical activity fulfilling the above criteria? Nordic Walking may be the answer to this question.

Nordic Walking – definition and history

Nordic Walking can be defined as a form of outdoor physical activity involving walking with use of poles adapted from cross-country skiing poles.

A less common name for cross-country skiing is Nordic skiing; therefore, the name Nordic Walking was analogically accepted^{11,12}.

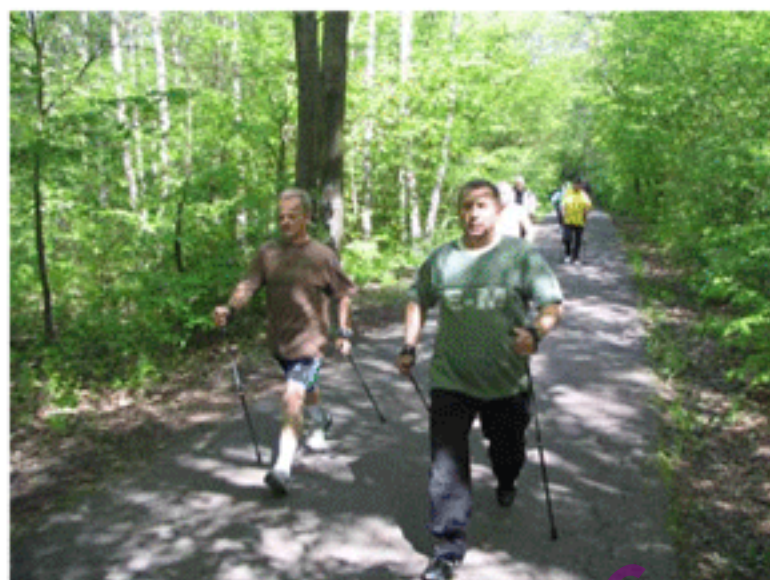
The idea of walking with poles was created in Finland by cross-country skiers several decades ago. The skiers were searching for a summer alternative for their sport discipline in order to remain fit and appropriately prepare for the winter season. Development of NW as a new form of activity and recreation was initiated after 1997, since the establishment of a co-operation between the Ministry of Sport of Finland, research scientists and a well-known manufacturer of winter sports equipment that designed the poles. Within several years, the interest in NW has rapidly increased. NW has spread beyond the borders of Scandinavia to Western Europe and recently also to Central Europe, including Poland. The popularity of NW is supported by the number of approx. 500 000 Finnish people, who have practised this discipline regularly for the last several years. This number constitutes nearly 15% of Finnish population, while over a half of inhabitants of this country did NW at least once in their lifetime.

Walking with poles has two principal functions:

- forces involvement of the upper body parts and activates muscles that are passive during a normal walk,
- partially unloads the lower extremities that may be excessively exploited during a normal walk.

These two advantages bring further benefits for health. The most important include:

- greater energetic expenditure – by 20-40% as compared to the standard walk,
- improvement in general agility in the articulations of the upper body part and the back as well as an improvement in the range of motion in these joints,
- improvement of general agility in the articulations of the lower body part via: partial unloading of the articulations of the lower extremities and of the lower parts of the spine and maintenance of normal joint mobility,
- amelioration of general feeling and mental comfort via: a possibility to do a high intensity discipline at a low subjective perception of fatigue, increased safety of walking with poles, improvement in mood and having fun^{11,13,14,15,16,17,18,19,20,21,22,23,24,25}.



Picture 1 a-c

The Nordic Walking training in inpatients of the Department of Cardiac Rehabilitation in Kiekrz

Technique of walking with poles

Although it may seem otherwise, Nordic Walking is not a completely easy activity and its learning requires time, attention, appropriate activation of various body parts, and coordination of movements. When learning the correct walking technique, the following factors should be considered:

- breaking in the correct, alternating and natural rhythm of gait,
- leaning the whole body forward avoiding flexion in the hip joints,
- increasing the stride length,
- the upper extremity should move within a vertical plane – beginning with flexion in the humeral and elbow joints (more or less at the level of iliac crests) and simultaneous handgrip on pole grips, in the push-off preparation phase – up to extension in the humeral and elbow joints with simultaneous hand opening and "release" of the pole that subsequently returns to the hand thanks to its attachment to the wrist of the walking person, at the time immediately preceding the push-off phase,
- the hand should be held possibly close to the trunk,
- during the push-off phase, the pole should be placed between the advancing limb on the contralateral side and the supporting limb on the ipsilateral side – approximately at the half of the step,
- the pole should be placed at an acute angle in relation to the ground – never on the square,
- the trunk performs an alternating rotation around the midline body axis.

Apart from learning the correct Nordic Walking technique on a plane surface, it is necessary to teach techniques of climbing up and going down.

Based on our experience, we conclude that the elderly patients, including patients of our hospital, have most difficulties with the movements of the upper extremities, primarily during the last phase of their work, i.e. extension in the elbow joint and "hand opening" with active relaxation of the muscles. As a result, the stride is shortened, excessive exertion and persistent muscular tension of the upper extremities occur thus quickly inducing their fatigue and the pain.

In addition, it should be noted that appropriate selection of the poles is essential for learning and maintaining the correct walking technique. Their length, elasticity and durability are important. To determine the length of the poles, the following formula may be applied – $0.68 \times$ patient's height, or the length of poles may be selected in such a way that a right angle is maintained in patient's elbow joint while standing. Level of agility, elasticity and joint mobility should be considered when selecting poles length. The better agility, the more justified is use of longer poles. Beginners and persons, who are not highly agile, should use appropriately shorter poles. The two remaining characteristics of the poles are affected by the material they are made of – different proportions of carbon and glass fibres. The principle of poles selection should be as follows: the more intense and more frequent are the trainings, the more difficult are the performed exercises, the more difficult are the outdoor conditions – the harder and lighter should be the poles – that is the proportion of carbon fibres to glass fibres should change towards the former.

Dependently on the form of walking and exercises performed during the training, various levels of NW can be distinguished:

NW Health – comprises basic Nordic Walking technique (NW Basic – push-off is performed only to the level of the hips, without extension in the elbow joint and "opening" of the hand during the terminal phase of push-off). The aim of this form is to achieve beneficial effects on health resulting from assuming a motor activity.

NW Fitness – where a full form of walking (elbow extension, hand "opening") is enriched with a variety of poles-assisted exercises, mainly respiratory, stretching muscle groups mostly involved in these exercises and a series of dynamic exercises characteristic for aerobic exertion. The training intensity is markedly increased. This type of NW should be selected by those, who aim at improving aerobic endurance and reducing body weight.

NW Sport is a level for the most advanced and engaged persons, involving skilful coping with and overcoming obstacles on the ground (e.g. climbing up a hill, walking down). Various types of training are used, e.g. circuit trainings, interval trainings that may include fitness exercises, runs, or jumps. At this level, training with use of poles can be used as the main form of exercises improving the strength, aerobic and non-aerobic endurance, or as an additional element of other types of training.

NW Health may be safely used even early after myocardial infarction. Because of the intensity and complexity of the NW Sport exercises, it is not useful in cardiac rehabilitation. During the late phase of rehabilitation, NW Fitness may be used. Very intensive exercises should be avoided or introduced with special caution. If the training is well planned, the NW Fitness exercises can be especially useful for persons wishing to reduce their body weight. Therefore, they may become an important element of secondary prevention of cardiovascular diseases.

Methodology of Nordic Walking exercises

There are no unequivocal rules of conduction of NW exercises. Everything depends on the group being trained. However, several principles do exist that should be complied with in order to increase the safety of training, which is particularly important when working with patients^{9,11}.

- Training session should be preceded by **warm-up** (10-15 min.), including stretching and respiratory exercises, to slowly introduce the patients into a higher training intensity and reduce the risk of injury, **the main part** (30-60 min.) – the walking, **the terminal phase** (10 min.) – the so-called cool-down phase – primarily in order to stabilise and normalise the functioning of the cardiovascular and respiratory systems.
- The intensity should be selected dependently on the level of advancement of the training; however, physical status, health and participant's abilities should be primarily taken into account. Training intensity should range 40-49% of heart rate reserve (HRR) or 55-64% of the maximum heart rate (HR max) in case of persons with low effort tolerance, including patients during early cardiac rehabilitation, whereas training intensity in patients with a good tolerance of exertion, without significant signs of myocardial lesion should range 60-80% HRR or 70-85% of maximum heart rate (HR max). In case of NW Sport, even an intensity leading to maximum exertion may be applied.



Picture 2 a-g

Examples of exercises performed by the patients during warm-up or during the terminal phase of the training

- The frequency of exercises should be reversely proportionate to their intensity, so that possibly highest energetic expenditure per week is achieved. Exercising 3 to 5 times a week is most often recommended.
- Walking effort may have a form of a continuous effort or, especially in case of rehabilitation patients, it is necessary to apply interval training at least during the first training sessions, where walking periods of 10-min duration are alternated with several-minute pauses for respiratory, stretching and balance exercises.

In all these forms of exercises, the poles should be used to the possibly greatest extent, which facilitates conduction of exercises allowing the patients to balance and equally load the muscular system. The poles are useful as early as in the phase of warm-up, when low-intensity exercises preparing selected muscle groups and small joints of the spine for the intensive effort are being performed. The poles facilitate specifically the performance of stretching exercises at outdoor conditions, most often in a standing position. These exercises are especially important – because one-sided loading of muscles during various forms of activity leads to conditions such as restriction of movements and abnormal biomechanics of the articulations thus increasing the risk of occurrence of pain syndromes and traumas within the joints and muscles. Stretching exercises are performed both at the initial

phase, during the main part and at the terminal phase of the training. They should involve multiple muscle groups, most importantly the following groups: the ischio-crural, the adductors, the gluteus medius, the piriform, the rectus muscle of thigh, the gastrocnemius, the soleus, the latissimus muscle of back, and the pectoralis muscles.

It is important not to neglect appropriate preparation of muscles and articulations of the vertebral spine. A lack of appropriate warm-up can induce uncomfortable pain in this region. It should be emphasised that, apart from the most frequently used exercises in a flexed position, hyperextension and rotation exercises of the spine are performed.

Except from the above mentioned help in stabilising the posture during various types of exercises (including exercises in pairs), the poles are useful in teaching different forms of respiration, e.g. lower-rib respiration, upper-rib respiration, etc.

During conduction of training in patients with cardiovascular diseases, basic principles of training applied in this domain of rehabilitation should be complied with. This pertains to avoidance of bending the trunk forward or long-term isometric tensions because of a possibility of raising the intrathoracic pressure and functioning of the organism in non-aerobic conditions.

While taking all the above assumptions into account, it is, however, worth bearing in mind that "anyone, who walks may do Nordic Walking, as it is designed for each level of agility, each gender and each age"¹¹.

State-of-the-art and perspectives of NW in future

Research studies conducted so far pertained mainly to the effects of exercise on selected indices of physical endurance and components of general agility of both healthy persons and patients with diseases and dysfunctions of the locomotor system. Advantages of using poles during walking have also been emphasized based on a comparison of the achieved effects of poles-assisted walking with results obtained in patients walking without the poles.

First studies, conducted in 1992, evaluated the effects of 12-week NW exercises on mental and physical general feeling in women at menopausal age, who were running a sitting style of life. It was demonstrated that physical efficiency and endurance were improved to a greater extent in women performing the training with poles than in those, who walked without the poles. Moreover, the study participants showed a significant reduction in experiencing depressive states, anger, and fatigue and demonstrated a greater vigour, better general feeling and mood. However, the 12-week training did not improve muscle strength^{19,20,21,22}.

In studies conducted in elderly persons, an improvement in all components of the physical endurance test designed for this age group was observed²³. Also, in the studies recently conducted in our centre, an improvement in results of the Fullerton test was demonstrated in patients at the early post-myocardial infarction state. It should, however, be emphasized that our recent observations comparing common effort associated with walking to the effort associated with NW (combined with general agility exercises with elements of endurance training) did not show such significant differences in the improvement in physical efficiency as demonstrated in endurance tests assessing the upper and the lower body, in elasticity and dynamic balance tests constituting parts of the Fullerton test. Conversely, the NW group showed a markedly greater improvement in physical endurance in 6-minute walking test, which – as it is known – is an important prognostic factor. This is the first study on the application of NW in the early phase of cardiac rehabilitation²⁴. Preliminary results obtained by our group are encouraging. The participants, apart from the significantly greater improvement in the physical agility test as compared to the control group (participant's group taking part only in the standard cardiac rehabilitation program), demonstrated an improved physical effort tolerance as assessed using the treadmill test⁹. Previously, the only observations on this aspect were conducted during the late phase of cardiac rehabilitation (3-4 months after an event), in laboratory conditions, using a treadmill¹⁶.

Of other reports, it is noteworthy to emphasize those indicating a possibility of using the exercises in Parkinson's disease²⁵ (improved quality of life, independence, etc., although the studies were performed only in males characterised by good agility, aged 16 to 72 years, who were able to perform 60-minute sessions of interval training, 3 times a week), peripheral vascular disease with intermittent claudication²⁶ (improved quality of life, increased length of the walking distance without the necessity to stop), or in persons absorbed by the turmoil of daily life – as a training decreasing subjective feeling of fatigue as well as reducing the shoulder and neck pain and improving the range of motion in these regions¹⁵. Interestingly, the study involved only women.

Authors of the majority of papers stress out a higher level of such indices as pulse rate, oxygen absorption, energetic expenditure at a concomitantly lower level of perceived exertion in patients walking with the poles as compared to results of the studies on persons walking without the poles^{13,14,16,17,18,19,21}.

Among multiple possibilities of application of training based on use of Nordic Walking poles, its introduction in the programs of rehabilitation of elderly persons seems obvious. In this case, participation in training of an intensity impossible to achieve in the available forms of physical activity, i.e. bicycle riding or jogging, should be considered. Additionally, feeling of safety as well as broad activation of almost all muscle groups may prove to be an undoubted advantage.

In the cardiac rehabilitation, Nordic Walking may become an alternative form of endurance effort and a new attractive form of walking training normally used in cardiac rehabilitation programs, also because of the higher energetic expenditure possibly inducing body weight loss that is so important in the secondary prevention of cardiac diseases.

Application of these exercises may be considered in all patients with problems in the neuromuscular balance or appropriate cooperation between the phasic and the tonic muscles, e.g. in chronic spinal pain syndromes, degenerative joint diseases, neuropathies, myalgias, musculo-fascial pains, etc. It is worth considering possible benefits for persons participating in the NW training, who have problems with proprioception, e.g. post-orthopaedic surgery patients, patients at a later stage after endoprosthesis implantation, patients after cruciate ligament reconstruction, or patients with a small neurological deficit resulting from cerebral stroke.

Nordic Walking, an undoubtedly continuously developing and more and more popular form of exercise, may become a powerful "tool" and an additional rehabilitation method in the contemporary, complex rehabilitation in various domains of its application.

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