The effect of Nordic Running to physiological aspects, health of runners and its possibilities of using in the school Physical Education

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Abstract
The article deals with Nordic Running as modern training tool in conditional preparation of athletes with different focus. It briefly describes Nordic Running in terms of the basic technical and technological equipment. The main part maps actual resource, which primarily deals with the effect of Nordic Running on the factors of Athlete´s sport efficiency, and also the effect on their health condition. In the end, the article focuses on the discussion about the use of this outdoor activity in school conditions, in fitness training for youth, overweight persons at seniors.

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Key words:
running with poles/Nordic Running, research, health

Souhrn
Článek se zabývá nordic runningem jako moderním tréninkovým prostředkem v kondiční přípravě sportovců různého zaměření. Ve stručnosti popisuje nordic running z hlediska základního technického a technologického vybavení. V hlavní části pak mapuje aktuální výzkum, zabývající se především vlivem nordic runningu na faktory sportovní výkonnosti u sportovců a také vliv na jejich zdraví. V závěru se pak věnuje diskusi o využití této outdoorové aktivity ve školních podmínkách, v kondiční přípravě u mládeže, u osob s nadváhou a u seniorů.

Klíčová slova:
běh s holemi, výzkum, zdraví

Introduction

In these days, a new modern tools for improving the fitness preparedness are seeking, for the diversity their preparation, disruption of training stereotypes, but also the improvement of technical perform of movement. One of those activities, which have emerged in fitness training by recreational and elite athletes in recent years, is Nordic Running (NR) or Nordic Walking (NW). It is about activities, which are based on natural movements of human activities, they are also combined with more significant movements of arms and upper body due to the use of specially modified poles. It is an enrichment of simple walking and running with the movement of arms with poles.

According to Kůtek (2013), has running with running-poles closer to the cross-country running classic technique, than to Nordic Walking. In easier form, it is an imitation of alternating two-stroke cross-country skiing without skis. The basis of correct version of running with sticks is to keep running technique, especially the movement of arms and elbows, in participation of poles to running. Arms are bended in elbows (approximately in the right angle) all the time, and alternatively waves parallel to the hips forward. Hand, holding pole in

this case, gets in forward position to the height of shoulder and in backward position to the hip (that means same as it is while running without poles).
Between main principles of correct running technique of Nordic Running belongs according to Kůtek (2013):

- Trunk is in slight slope forward
- The bounce of poles is time and space shorter than bounce while cross-county running in classic technique
- The pole is sticked roughly at the level of foot of opposite legs
- The movement of arm with pole ends with the position of hand by hip, that means it is not continuing towards behind trunk (thereby running with poles differs from both Cross-Country and Nordic Walking in tightening elbow backwards)
- The movement of hand on hand grip is slightly rolling; grip is not squeezed solid nor too released
- Very important is proper length of running poles (for the length is recommended this conversion: body height x 0,8 ± 3 cm)

It is necessary to state, that NR with NW are not new in recent years. It was first mentioned in 30ties of 20th century, when walking and running with poles was from the beginning of organized skiing, considered to be the main training issues for all cross-country skiers. Before the rise of roller ski these exercises were practically the only complex method of development of strength endurance during summer trainings of cross-country skiers. Pointing up bounce of legs while walking, running or jumping in terrain are one of the main methods for the whole time of summer trainings in these days (Bolek, Ilavský & Soumar, 2008, Nosek & Műllerová, 2015). What is new, is the effort of connection of this training tool to the conditional trainings in various sport disciplines.

Objective

The main issue of this article is to analyse available studies of influence of Nordic Running on athlete´s performance, influence on their health condition and use in motional modes by recreational athletes.

Methods

In the creation of this article were used theoretical methods, that is the descriptive and comparative, which were used for comparing of individual results, from available researches, that deals with the influence of Nordic Running on the power and performance. From the empiric methods was chosen the direct participant observation, where the performance but also recreational athletes were watched while running with poles training. On the basis of these methods, the discussion on these theme were lead, about the suitability and use of NR in fitness training of performance athletes, of school children, overweight people and seniors.

Results

In the following chapter, we bring available studies that rates the influence of Nordic Running on the performance of athletes, and influence on their health condition.

The influence of Nordic Running on physiological aspects

Research works which deals with NR is not a lot. Far more research studies is focused on NW. In the conclusion of the row of studies focused on NW (Parkatti et al., 2012; Piech & Raczyńska, 2010; Sokelienë & Cesnaitienè, 2011;) is the engaging of arms to the movement while walking. It allows more intensive engaging of arms, shoulders and back muscles. The result is lightening of lower limbs. More involved muscles by walking has the result increased heart rate of 15% and higher energy consumption by 20-50%, compared to fitness walking without poles by practically same effort. In prolonged performance (in the aerobic zone) occurs burning of more fat, because of that walking with poles helps to increase condition more effectively than normal walking.
From these facts arises the suggestions for use of NR in fitness training of athletes. Propagators of Nordic Running became the pair of athletic trainers. Tvrzník and Kůtek (2012) involved this training tool to the fitness training of athletes. As the first, they made research study and published results at the symposium EAAF. From the results of experimental research, which studied if the burden of lower limbs is reducing while NR. It was found that this burden has decreased of 5% by every step down. At the same time, they found that while running with poles the heart rate increased of 15-20% and the total energy output increased of 25% (Tvrzník & Kůtek, 2012).
Bahenský and Michalov (2014) tried to verify this fact, they were looking for physiological burden of organism while running with poles and also without them, using 7 young men and 9 women. They compared measured lactate values and the

average of heart rate with values while running in the same speed without poles. Their investigation suggest, that while running without poles, there is significantly lower level of lactate and also average of heart rate (2,8±1,0 mmol/l and average heart rate, 178,3±9,1 beats/min), than while running with poles (5,0±1,6 mmol/l and average heart rate 178,3±9,1 beats/min). According to their conclusions we can state that running with poles burden organism demonstrably more than simple running. In the next research, Pokorný (2015) tried to focus on the influence of movement with poles and without poles. He rated the difference in heart rate while using poles and without, the difference was 13 %, that is the number comparable with other studies results, which rated 14 – 16 % (Bahenský&Michalov, 2014, Kůtek, 2012). In the next research the author focused on the identification of maximal speed by NR in 100m track. Value founded of maximal speed was 22,1 km/h, the best time in 100m was 18,0 sec and the highest average speed 5,6 m/s, respectively 20 km/hod. From these facts later, considered author possible positive relation between speed of NR and length of lower limbs. The results of the study did not confirmed these facts (Pokorný, 2015).

The influence of Nordic Running on the Health of runners

The next area, in which is the research realized, is the influence of Nordic Running on the Health of runners. With this issue dealt for example Bolt (2000). She focused her research on biomechanical analysis of movement while running without poles and with poles. The research was carried out at 10 recreational runners with knee pain, and it revealed that the use of poles while running has significant influence on the burdening of knees. There was a significant decrease in the average of peak power and pulse, and a significant increase in torque point of the hip joint. It was concluded that by providing an outside source of propulsion, running with poles may be useful in reducing the risk of injury to runners

On the similar research of study focused French study (Daviaux, Hintzy, Samozino & Horvais, 2012). They focused on the influence of running on the pressure of foot in varying terrain slope using poles or without them. Ten runners ran on a loop track representative of a trail running field situation with uphill level (+9°), and downhill (-6°) sections at fixed speed (3.2 m.s (-1)). Experimental conditions included running with (WP) and without (NP) use of poles for each of three slopes. Several quantitative and temporal foot-ground interaction parameters were calculated from plantar pressure data, measured with a portable device. Using poles induced a decrease in plantar pressure intensity even when the running velocity stayed constant. However, the localisation and the magnitude of this decrease depends on the slope situation. During WP level running, regional analysis of the foot highlighted a decrease of the force time integral (FTI) for absolute (FTIabs; -12.6%; $P<0.05$) and relative values (FTIrel; -14.3%; $P<0.05$) in the medial forefoot region. FTIabs (-14.2%; $P<0.05$) and duration of force application (Δt; -13.5%; $P<0.05$) also decreased in the medial heel region when WP downhill running. These results support a facilitating effect of pole use for propulsion during level running and for the absorption phase during downhill running

The influence of poles on the Health condition while NW were researching Italian scientists (Pellegrini, Peyré-Tartaruga Zoppirolli, Bortolan, Bacchi, Figard-Fabre, et al., 2015). The aim of the study was to assess differences in muscle activation and physiological responses between nordic walking (NW) and walk (W) in level and uphill walking conditions. Nine experts Nordic Walkers (mean age 36.8±11.9 years; BMI 24.2 ±1.8 kg/m2) performed 5-minute treadmill trials of W and NW at 4 km/h on inclines of 0% and 15%. The electromyographic activity of seven upper body and five leg muscles and oxygen consumption (VO2) were recorded and pole force during NW was measured. VO2 during NW was 22.3% higher at 0% and only 6.9% higher at 15% than during W, while upper body muscle activation was 2- to 15-fold higher under both conditions. Lower body muscle activation was similarly increased during NW and W in the uphill condition, whereas the increase in erector spinae muscle activity was lower during NW than W. The lack of a significant increase in pole force during uphill walking may explain the lower extra energy expenditure of NW, indicating less upper body muscle activation to lift the body against gravity. NW seemed to reduce lower back muscle contraction in the uphill condition, suggesting that walking with poles may reduce effort to control trunk oscillations and could contribute to work production during NW. Although the difference in extra energy expenditure between NW and W was smaller in the uphill walking condition, the increased upper body muscle involvement during exercising with NW may confer additional benefit compared to conventional walking also on uphill terrains. Furthermore, people with low back

pain may gain benefit from pole use when walking uphill.

From results of these studies is significant, that the use of poles reduces the risk of musculoskeletal injuries. Besides higher stability while running, poles reduce the load bearing joints of the lower extremities and spine, as part of the load take arms.

Discussion

According to many studies (Bolt, 2000; Daviaux, Hintzy, Samozino & Horvais, 2012), the main benefit Nordic Running is the health aspect. It is proven, that while running occurs large burden of musculoskeletal system. If there is not enough compensation, the muscle imbalances are formed, which lead to changes in movement stereotypes. The technique of running is changing, thereby performance reduction with subsequent overloading of the ligaments, tendons and joints (Malátová & Matějková, 2011; Malátová, Rokytová & Štumbauer, 2013). Nordic Running helps to reduce the burdening of bearing joints, through the support of hands on poles. In the researches was found, that while using poles the burdening on lower limbs is reducing over 5 % by every step down, what is in long distances big relief (Daviaux, Hintzy, Samozino & Horvais, 2012; Tvrzník & Kůtek, 2012).

It is obvious, that NR may be used by different groups of population. Inclusion of NR may be appropriate for instance by recreational overweight runners. Excessive weight may have negative influence on the joint apparatus of overweight runners, and using poles may help to partly move this burden to the upper limbs area. Use of poles can also help with stability of these runners. I would not recommend this activity to the individuals suffering obesity, especially for higher physiological load in the anaerobic mode, which may occur while NR. Preferable activity is Nordic Walking.

The situation is analogical by seniors. Considering the fact, that while suggesting movement modes for seniors is recommended to use practically only endurance forms of physical activities, Nordic Running may be inserted, but it is necessary to look at the current health condition and physical ability of seniors every time.

The area, in which NR may be used is School Physical Education. Use of NR by school children can help the attractivity of the education, for example in the school courses or school trips. Adding poles may help the coordination of arms and lower limbs movement while running training. With poles is also possible to do dynamic exercises for the strength development of lower limbs. One of the problems may be the facilities of pupils and schools with poles appropriate for NR, but it is possible to use Nordic Walking or Skiing poles also.

Besides preventive health aspects of running with running-poles it is obvious, that NR helps primarily as the training tool due to increasing of the burdening intensity. According to many studies (Bahenský & Michalov, 2014; Pokorný, 2015; Tvrzník & Kůtek, 2012), runner with poles has significantly higher energy output than while casual running. More intensive burdening of circulatory and respiratory system occurs, and far greater involvement of upper limbs and muscles of the thoracic area.

The area, which has not been researched enough yet, is the influence of NR on the improvement of the running technique and coordination abilities, so effective interplay of muscles and limbs, which is necessary premise for improving running performance.

Conclusion

Nordic Running is a modern form of outdoor activities. Benefits may be observed in the Health condition area, because while running with poles the burdening of bearing joints of lower limbs and spine is reducing. Indisputable is also the effect of increasing the physiological body burdening, which occurs while running. The preference of NR is the possibility of accommodation the intensity of movement to various target groups, according to their Health condition, physical ability and sport level. NR has also potential in School Physical Education. Inclusion of NR to the lessons may help to make lessons more attractive, and more effective rehearse of the swing running technique. This falls in the region, which has not been researched enough yet, and in which we want to continue researching. In the following study, we would like to focus on the analysis of influence of NR on the running technique by various groups of runners.

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