EFFECT OF 3-WEEK NORDIC WALKING TRAINING ON THE LEVEL OF AEROBIC PHYSICAL FITNESS AND BODY COMPOSITION OF YOUNG WOMEN

Rafał **SZAFRANIEC**[1 (A,C,D,E)], Katarzyna **SZCZYPTA**[2 (B,F)], Małgorzata **FORTUNA**[2 (E,F)]
Iwona **DEMCZYSZAK**[2(E ,F)]

1. Faculty of Sport Science, University School of Physical Education, Wroclaw, Poland
rafal.szafraniec@awf.wroc.pl
2. Faculty of Natural Sciences and Technology, Karkonosze College in Jelenia Gora, Poland

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Abstract:
Introduction. Nordic walking is a comprehensive form of exercise for every age group and gender, both for people with poor physical condition, as well as high-performance athletes. Using the correct technique of Nordic walking, we engage as much as 90% of the body muscles.
The aim of the work. The aim of this study was to verify whether the application of short-term (3 weeks) Nordic walking training in any way affect the level of aerobic physical fitness and body composition of young women.
The material and the methodology. The study involved 10 women aged 22-23 years. Nordic walking training was held 3 times a week for three weeks. Training unit time was 60 minutes. Before and after completing the training cycle the level of aerobic physical fitness (Astrand-Rhyming test) and body composition by bioelectrical impedance was assessed.
Results. An increase of VO_2max from 2.1±0.08 to 2.2±0.11 l/min (p=0.02) was observed. VO_2max, taking into account the body weight of subjects, increased by 1.6 ml/kg/min (p=0.005). Body weight decreased by 0.8 kg from 60.3±7.32 to 59.5±6.79 kg (p=0.01). Body fat was reduced after the training by 0.5% (p=0.01), whereas the percentage content of skeletal muscles increased by only 0.1%, and this change was not statistically significant.
Conclusions. Even short-lasting, but regular Nordic walking training can cause favorable adaptive changes in organisms of healthy young women. After 3 weeks of training, there was an increase in aerobic physical fitness, a reduction of body weight and percentage content of body fat.

INTRODUCTION

The march is the most common activity undertaken every day. Nordic walking is a natural walking, enriched with the technique of pushing off the ground with poles that we hold in our hands. The idea behind this relatively new form of recreation is to engage muscles that are not used during normal gait. While walking with poles, using proper technique, the upper body and as much as 90% of all muscles are engaged. Nordic walking is a comprehensive form of exercise for every age group and gender, both for people with poor physical condition, as well as for high-performance athletes. It is easy and fast to learn [7].

The use of poles significantly unweight the joints of the lower limbs, so you can train more intensively, and the likelihood of injuries and overloading of the joints is reduced. The training should be done with moderate intensity and take more than 30 minutes. It is recommended to athletes during training to run with poles, jump and run uphill. Covering at a fast pace the long distances at high altitudes, those who are more advanced can achieve above-average energy expenditure. Research conducted by the Cooper Institute show that Nordic walking allows to burn more calories, results in a greater oxygen uptake and is a form of recreation for 46% more efficient than a normal walk. This explains the rapid loss of body weight and cholesterol levels in people practicing walking with poles. Using the correct technique of Nordic walking, we engage as much as 90% of the body muscles while, during walking only about 70% is used [1]. Additional benefits include a small financial outlay, availability of equipment and simplicity of movement [4,5].

THE AIM OF THE WORK

The aim of this study was to verify whether the application of short-term (3 weeks) Nordic walking training in any way affect the level of aerobic physical fitness and body composition in young women.

THE MATERIAL AND THE METHODOLOGY

The study involved 10 healthy women (n = 10), third-year students of physiotherapy in Karkonosze College in Jelenia Gora. Age of the study group was 22-23 years (22.1 ± 0.3).

Nordic walking training

Nordic walking training was held 3 times a week for three weeks. Training unit time was 60 minutes. The march took place in a terrain on a flat asphalt surface. The initial distance was 5 km, and after each workout the distance was increased by 250 meters, up to 7 km at the 9th training unit. The subjects had classes of the methodology of walking with poles (35 hours) during education at Karkonosze College in Jelenia Gora, therefore they did not have to be additionally trained before the experiment to march according to the principles of Nordic walking.

Aerobic physical fitness

Aerobic physical fitness was evaluated by the Astrand-Rhyming test, which is an indirect method for determining maximal oxygen uptake (VO_2max) based on heart rate during submaximal exercise [12].

Body composition

Body composition was measured by bioelectrical impedance with Body Composition Monitor BF511 (OMRON, Japan). Prior to the measurement, age, sex and height of a subject were introduced into the device. Then, the person was standing on the central unit by placing feet on the electrodes and evenly spacing the body weight. When the display showed "START", the subjects clenched their hands on the electrodes, standing with a straight trunk, straight knee joints and looking ahead. The device measures the following parameters: body weight [kg], BMI, the percentage of body fat, the percentage of skeletal muscles, resting metabolism [kcal/day].

Assessment of aerobic physical fitness and body composition were made twice:

TEST 1 - before starting the training program in order to determine reference values,

TEST 2 - three days after the 3-week Nordic walking training, in order to determine any changes in measured parameters

The procedures were performed always at the same time of day, in hours 17.00-19.00, strictly according to the methodological instructions provided by the manufacturer of body composition analyzer and by the authors of Astrand-Rhyming test.

Obtained during the examination data were presented in the form of mean values, minimum, maximum, and standard deviations. In order to compare results obtained in TEST 1

and TEST 2, the non-parametric Wilcoxon signed-rank test was used. Statistically significant differences were considered when $p \leq 0.05$. Statistical analysis was performed using the computer program STATISTICA 10.0 (StatSoft).

RESULTS

Before the beginning of the Nordic walking training, the mean values of heart rate steady state during Astrand-Rhyming test was 162.3 ± 4.03 bpm, and after 3 weeks of walking with poles average heart rate decreased by 1.9 bpm and was 160.4 ± 4.55 bpm (table 1). This difference was statistically significant at $p = 0.008$ (table 2). It was also observed that mean values of VO_2max had increased from 2.1 ± 0.08 l/min to 2.2 ± 0.11 l/min ($p = 0.02$). VO_2max, taking into account the body weight of the subjects, increased by 1.6 ml/kg/min ($p = 0.005$). In TEST 1, the mean VO_2max was 36.1 ± 4.53 ml/kg/min, while in TEST 2 - 37.7 ± 4.39 ml/kg/min.

After completing the training, there was a decrease in body weight of the examined women by an average of 0.8 kg ($p = 0.01$) - table 2. In TEST 1, the mean value of body weight of participants was 60.3 ± 7.32 kg, while in TEST 2 - 59.5 ± 6.79 kg. After the training, BMI has reached the mean value of 21.1 ± 2.81, compared to 21.4 ± 3.04 in the initial test. This difference was statistically significant at $p = 0.01$. The average body fat decreased after the training by 0.5% ($p = 0.01$). In TEST 1 it was 31.2 ± 7.31%, and in TEST 2 - 30.7 ± 7.28%. As a result of the conducted training, the mean value of percentage content of skeletal muscles in the bodies of young women increased by only 0.1%, and this change was not statistically significant. Also, considering the mean values of resting metabolic rate in the study group, there was no statistically significant changes.

Table 1. Descriptive statistics of the measured parameters in both tests.

	TEST	N	Mean	Min	Max	SD
HR steady state [bpm]	1	10	162.3	156.0	168.0	4.03
	2	10	160.4	153.0	166.0	4.55
VO_2max [l/min]	1	10	2.1	2.0	2.3	0.08
	2	10	2.2	2.1	2.4	0.11
VO_2max [ml/min/kg]	1	10	36.1	27.7	42.5	4.53
	2	10	37.7	30.0	45.1	4.39
Body mass [kg]	1	10	60.3	50.0	72.1	7.32
	2	10	59.5	49.9	70.0	6.79
BMI	1	10	21.4	18.4	25.9	3.03
	2	10	21.1	18.3	25.5	2.81
Body fat [%]	1	10	31.2	22.1	41.8	7.31
	2	10	30.7	21.9	41.7	7.28
Skeletal muscles [%]	1	10	27.8	23.4	31.4	3.04
	2	10	27.9	23.2	31.7	3.17
Resting metabolism [kcal/day]	1	10	1336.0	1215.0	1482.0	75.47
	2	10	1330.7	1216.0	1470.0	73.69

Source: author's own study.

Table 2. Wilcoxon signed-rank test. Significant differences between the TESTS are marked ($p \leq 0.05$); 1, 2 - numbers of the following TESTS.

Variables	T	Z	p
HR steady state 1 vs. 2 [bpm]	0.00	2.666	0.008
VO_2 max 1 vs. 2 [l/min]	0.00	2.366	0.02
VO_2 max 1 vs. 2 [ml/min/kg]	0.00	2.803	0.005
Body mass 1 vs. 2 [kg]	1.50	2.488	0.01
BMI 1 vs. 2	2.00	2.429	0.01
Body fat 1 vs. 2 [%]	3.00	2.497	0.01
Skeletal muscles 1 vs. 2 [%]	23.00	0.459	0.6
Resting metabolism 1 vs. 2 [kcal/day]	10.00	1.784	0.07

Source: author's own study.

DISCUSSION

The study, which was conducted in a group of young women, was to show whether and to what extent, short-lasting, but regular and increasing gradually in intensity Nordic walking training, affect aerobic physical fitness and body composition.

A systematic physical activity significantly affects the increase in exercise capacity, improves physical and mental health. These facts are confirmed by numerous scientific studies [8]. Laurentowska et al., in their study, demonstrated that 8-week training on bicycle ergometer with a load of 80% of the individual threshold power contributed to the increase in VO_2max of the examined group by an average of 3.74 ml/kg/min. Also the exercise tolerance has improved, which was reflected by an increase in the amount of work performed during the exercise test, with similar heart rate [9]. Many studies on Nordic walking confirms the advantages of this form of physical activity compared with others - march without poles or jogging. Research conducted on 15 individuals showed that while walking with poles, oxygen uptake is higher by an average of 8% compared to the march and jogging [11]. Church et al. compared the physiological parameters during normal walking and Nordic walking, testing 22 volunteers in the Cooper Institute. Studies have shown the increase of approx. 20% in oxygen consumption and energy expenditure in walking with poles, compared with the usual march [2]. Porcari et al. examined 32 persons (16 women and 16 men) aged 19-32 years, and found that while walking with poles, oxygen uptake was on average higher by 23%, energy expenditure by 22% and heart rate by 16%, comparing the march on a treadmill without poles. Fatigue, as measured by the RPE scale, was about 1.5 units higher when walking with poles. These changes were similar in nature in both the women and men [10]. Similar results were obtained by a team led by Figard- Fabre, who examined a group of 12 obese women. Workouts were held 3 times a week for 12 weeks. After completion of the training cycle, there was an increase of VO_2max of 3.7 ml/kg/min ($p = 0.005$) and a reduction of body weight from 86.1 kg to 84.6 kg ($p = 0.045$), the thickness of the skin folds of 7.1 mm ($p = 0.02$) and fat content from 41.5% to 40.6% ($p = 0.01$) [3]. The direction of changes is fully consistent with the results of our work. Only the scale of changes is greater in the study of Figard- Fabre et al. The reason may be the four times longer the duration of the training, which was applied by Figard- Fabre et al., or the fact that in their research physical effort was performed by obese persons. In our experiment, however, have been involved women of normal weight.

Hager-Derengowska et al., using the Harvard test, demonstrated an improvement in exercise capacity after 6-week Nordic walking training. Before training, the value of the

indicator measured in the Harvard test was 77.08 ± 15.9 points, and after the training - 86.95 ± 8.1. The rate of pulse decline in the first three minutes of restitution after the Harvard test significantly increased in the control study [6].

These studies confirm the findings of our paper, although the training we have applied was by far the shortest.

CONCLUSIONS

Even short-lasting, but regular Nordic walking training can cause favorable adaptive changes in organisms of healthy young women. After 3 weeks of training, there was an increase in aerobic physical fitness, a reduction of body weight and percentage content of body fat. Although these changes were not large, it seems interesting that such a short time was sufficient that these changes occurred. There was no significant improvement only in the percentage content of skeletal muscles and resting metabolism. In this case, the training time turned out to be probably too short.

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