



The Effect of Nordic Walking Exercise Training on Physical Fitness, Physical Activity Level, Anxiety-Depression and Quality of Life in Smokers: A Randomized Controlled Trial

Sigara İçen Bireylerde Kuzey Yürüyüş Egzersiz Eğitiminin, Fiziksel Uygunluk, Fiziksel Aktivite Düzeyi, Anksiyete-Depresyon ve Yaşam Kalitesi Üzerine Etkisi: Randomize Kontrollü Bir Çalışma

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ABSTRACT

Aim: The aim of study was to investigate effects of nordic walking exercise (NWE) on physical fitness, physical activity, anxiety-depression level and quality of life in smokers.

Material and Methods: 30 smoking individuals with a mean age of 31.45±12.75 years were assigned randomly into two groups: NWE (n=15) or control group (n=15). NWE group performed NWE three times a week for 6 weeks and gradually increasing to 45 min a day. No intervention was made in control group. The health-related physical fitness level was assessed with arm curl test (upper extremity endurance), chair sit and stand test (lower extremity endurance), two minutes step test (aerobic endurance), sit and reach and back scratch test (flexibility), eight foot up and go test (balance), 6-minute walk test (MWT) (cardiopulmonary endurance). Physical activity levels with International Physical Activity Questionnaire (IPAQ) short form, anxiety-depression level with Beck Depression Questionnaire, quality of life with Nottingham Health Profile (NHP) were evaluated. The differences in measurement parameters between two groups were evaluated by the Mann Whitney U Test since the data distribution was nonparametric. The distinction between categorical variables were determined by Chi-square test.

Results: 6-MWT distance (p=0.005), two minutes step (p=0.022), IPAQ walking scores (p=0.028) statistically significant improvements were observed in NWE group. In control group, 6 MWT distance (p=0.025), two minutes step (p=0.032), sit and reach (p=0.043) scores decreased statistically significantly. 6 MWT distance (p=0.006), two minutes step (p=0.021), 8 foot up and go (p=0.005), IPAQ walking (p=0.045), moderate intensity activity (p=0.038), total scores (p=0.013), NHP emotional (p=0.045), total (p=0.045) scores significantly differed in favor of NWE group.

Conclusion: It is thought that NWE may be effective and alternative exercise approach in increasing physical fitness, physical activity level and quality of life in smokers and guided to rehabilitation programme.

Keywords: Nordic walking, Smoking, Physical fitness, Physical activity, Quality of life

ÖZ

Amaç: Çalışmanın amacı sigara içen bireylerde kuzey yürüyüş egzersizinin (KYE) fiziksel uygunluk, fiziksel aktivite, anksiyete-depresyon düzeyi ve yaşam kalitesi üzerine etkisini belirlemektir.



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Gereç ve Yöntemler: Yaş ortalaması $31,45 \pm 12,75$ yıl olan 30 sigara içen birey rastgele olarak iki gruba ayrıldı: KYE (n=15) veya kontrol grubu (n=15). KYE grubu, 6 hafta ve dereceli olarak artarak günde 45 dakika boyunca haftada üç kez KYE yaptı. Kontrol grubuna herhangi bir müdahale yapılmadı. Sağlıkla ilgili fiziksel uygunluk düzeyi, kol bükme testi (üst ekstremité endüransı) ve sandalyede otur kalk testi (alt ekstremité endüransı), iki dakika adım testi (aerobik endürans) otur ve uzan ve sırt kaşıma testi (esneklik), sekiz adım kalk ve yürü testi (denge), altı dakika yürüme testi (DYT) (kardiyopulmoner endürans) ile değerlendirildi. Fiziksel aktivite seviyeleri, Uluslararası Fiziksel Aktivite Anketi (UFAA) kısa formu, anksiyete-depresyon düzeyi Beck Depresyon Anketi, yaşam kalitesi Nottingham Sağlık Profili (NSP) ile değerlendirildi. Veri dağılımının parametrik olmaması nedeniyle iki grup arasındaki ölçüm parametrelerinin farklılıkları Mann Whitney U Testi ile değerlendirildi. Kategorik değişkenler arasındaki ayrım Ki-kare testi ile belirlendi.

Bulgular: KYE grubunda, altı DYT mesafesi ($p=0.005$), iki dakika adım ($p=0.022$), UFAA yürüme ($p=0.028$) skorlarında istatistiksel olarak anlamlı iyileşmeler gözlemlendi. Kontrol grubunda 6 DYT mesafesi ($p=0.025$), iki dakika adım ($p=0.032$), otur-uzan ($p=0.043$) test skorları istatistiksel olarak anlamlı şekilde azaldı. 6 DYT mesafesi ($p=0.006$), iki dakika adım ($p=0.021$), sekiz adım kalk yürü ($p=0.005$) testleri, UFAA yürüme ($p=0.045$), UFAA orta şiddetli aktivite ($p=0.038$), toplam puan ($p=0.013$), NSP duygusal ($p=0.045$) ve toplam ($p=0.045$) puan alt parametreleri iki grup arasında KYE grubu lehine istatistiksel olarak anlamlı farklıydı.

Sonuç: KYE'nin sigara içen kişilerde fiziksel uygunluk, fiziksel aktivite düzeyi ve yaşam kalitesini artırmada etkili ve alternatif bir egzersiz yaklaşımı olabileceği ve rehabilitasyon programlarına yön vereceği düşünülmektedir.

Anahtar Sözcükler: Kuzey yürüyüşü, Sigara, Fiziksel uygunluk, Fiziksel aktivite, Yaşam kalitesi

INTRODUCTION

Cigarette consumption is strongly associated with worsening overall health. Cigarette consumption is the most important modifiable risk factor among chronic diseases and premature death (1). It is the most important primary cause of cardiopulmonary diseases and some cancer types (1,2). The cardiovascular, respiratory, immune problems, musculoskeletal system and other organ systems disorders also occur along with smoking exposure. Besides, it is stated that muscle strength and endurance decrease in smokers (2-4). All these changes can affect the exercise capacity, physical activity and fitness levels of smokers and reduce the quality of life progressively. Previous studies comparing smokers to non-smokers, have shown that exercise capacity, physical fitness levels and quality of life are lower in smokers (2-5).

It is not sufficient to evaluate the affected quality of life in smokers only as a limitation in daily living activities. Quality of life is significantly affected in multiple domains. Although a reduction in the functional sub-parameter of quality of life is clearly demonstrated, negative effects on mental health are also seen. The biopsychosocial model proposes that physical, psychological, and social factors must be determined together to fully understand clinical outcomes. It emphasizes that physical evaluation cannot adequately predict the clinical outcome, because of that, psychological and social evaluations should also be taken into consideration (6).

Exercise has been shown in studies to have a preventive role against smoking, as well as a positive effect in prevention and cessation interventions. The results of these studies emphasize that new methods have to be developed as a smoking cessation method and the new holistic methods can be beneficial in achieving the desired success (5,7).

Nordic walking, defined as Scandinavian walking, is shown as a popular physical activity alternative. Special designed exercise poles are used to activate the upper part of the body. The biggest advantage is that the ground reaction force, which causes an increase in energy consumption, is met by the active use of the upper extremity muscles during walking (8,9). In the literature, the effectiveness of nordic walking exercise (NWE) has been investigated in conditions such as elderly people, obesity, cardiopulmonary diseases, parkinson, hemiplegia and peripheral arterial disorders. In these studies, it has been reported that NWE improves balance, flexibility, aerobic capacity, muscle strength, coordination and quality of life. In addition, it has been proven to have positive effects on cardiovascular risk factors in chronic diseases such as diabetes mellitus, hypertension and dyslipidemia (9). It has been found to have beneficial effects on patients' resting heart rate, blood pressure, exercise capacity, maximum oxygen consumption, and quality of life. Due to these effects, it is recommended in the literature as primary and secondary protection for a wide variety of people (9). The previous studies all came to the same conclusion: more research is necessary to confirm the efficacy of NWE (9-12). There are only two studies that examined the efficacy of NWE in prediabetic individuals and prehypertensive postmenopausal women were found in Turkey (13,14). As a result of these studies, it has been reported that NWE has positive effects on functional and physiological parameters and NWE can be an alternative exercise approach in Turkey.

Considering the benefits of nordic walking exercises shown in the literature, nordic walking exercises may be an effective method to reduce the negative effects of smoking on body systems and to encourage smoking cessation. However, there is not any study that examined the effectiveness of NWE in smokers in the literature. In this article, the primary aim of our study is to examine the outcomes of

NWE on physical activity, fitness level, quality of life and anxiety-depression in smokers.

MATERIAL and METHODS

Study Subjects

This study was carried out on 30 volunteers between the ages of 18-45 who had been smoking for at least 6 months and had not involved in any other exercise program during nordic walking exercise training between 23.02.2022 and 20.06.2022. This study included 30 volunteers between the ages of 18 and 45 who had been smoking for at least 6 months and during the nordic walking exercise training. The subject that having severe heart disease, systemic diseases, psychiatric diseases, musculoskeletal system diseases that may prevent exercising, coordination problems, vestibular system problems and having pregnancy history are excluded in this study. All participants gave their written informed consent.

The research project was approved with the decision of Baskent University Non-Interventional Clinical Research Ethics Committee dated 23/02/2022 and numbered 22/34.

Study Design

The sample size of the study was calculated according to the time up go test datas in the study of Nemoto et al. (15). When it was desired to determine the moderate to large difference (effect size was 1.07) with a 5% error and 80% power, it was found appropriate to work with a total of 30 smokers, at least 15 in each group. G * Power 3.1.9.2 software 54 program was used for sample size calculation.

Smoker subjects were split into 2 different groups as a nordic walking exercise (n=15) and control (n=15) by using a randomization computer program (<https://www.randomiser.org/lonks/QuickCalcs>) as shown in CONSORT flow diagram (Figure 1). NWE exercise training was applied to smokers in a NWE group. The smokers in control group

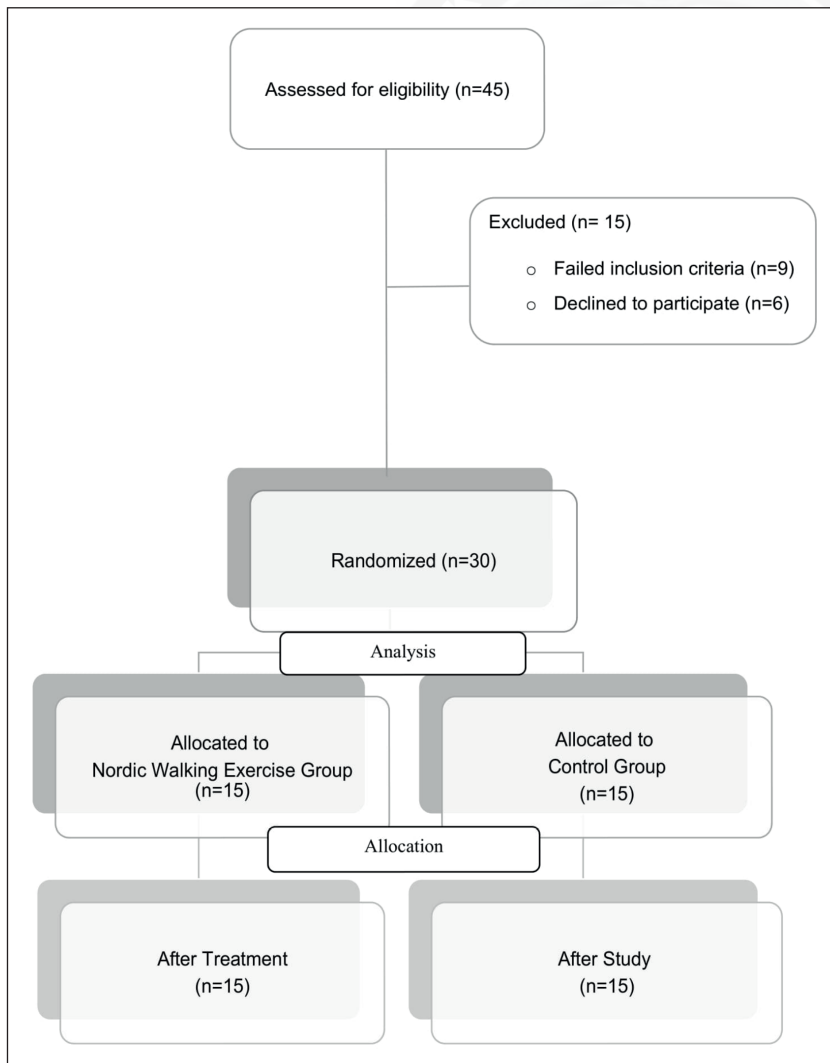


Figure 1: Study flow diagram.

were not given any exercise, only pre- and post-research outcome measurements were taken.

Anthropometric and socio-demographic information such as age, gender, height, body weight, cigarette consumption, and nicotine addiction values were recorded. The nicotine addiction was evaluated by Fagerström test for Nicotine Dependence. A score of 0-2 points, little; 3-4 points, very little; 5 points, moderate; 6-7 points, high; 8-10 points indicates very high dependence (16,17). Outcome measurements were taken for both groups at the beginning of the study and at the end of the 6th week.

Outcome Measurement

Physical fitness level

The aerobic endurance, muscular endurance, cardiopulmonary endurance, flexibility and balance that are sub-parameters of health-related physical fitness were evaluated (18).

The lower limb endurance was evaluated by chair sit and stand test. Participant's standing number that could be performed in 30 seconds (19).

The upper extremity muscular endurance was evaluated by arm curl test. Participants were asked to fully bend and open their forearms with the weight in their hands while the arm was adjacent to the body for 30 seconds. The maximum number of forearm bending and stretching repetitions was recorded for both arms separately (20).

The aerobic endurance was evaluated by two-minute step test. The midpoint between the crista iliaca and the patella when the participant was standing was determined as the target height. The participant was asked to pull the left knee first and then the right knee to reach the target height for two minutes. The right steps number reaching the target height at the end of 2 minutes was recorded (21).

The lower extremity's flexibility was measured by sit and reach test. The participant was instructed to reach forward with his torso with both hands and reach up to the tips of his toes, without bending the knee, which was extended to full extension. If the fingertips do not touch the toes, the distance between them is "-" in centimeters; zero "0" if the middle finger tip touches the toe tip; If the finger tip is past the toe tip, the distance of the tip of the middle finger was calculated by taking "+" in centimeters (22).

The back scratch test is used to evaluate upper extremity flexibility. Participant, one arm across the same side shoulder to the back, palm facing back, fingers trying to reach the lowest level on the back; internally rotating the other arm, participants attempted to reach the maximum point on their back, palms facing forward. If participant's middle fingers couldn't touch each other, the distance was calculated as

"-", "0" if they touched end to end, and "+" if one passed the other, as the distance between the middle finger in centimeters (23).

The dynamic balance was examined by eight foot up and go test. The participant was instructed to get up while sitting on the chair, turn around the funnel at a distance of 8 steps (2.44 m), come back to the chair and sit down, and the elapsed time was recorded (24).

The cardiopulmonary endurance was evaluated by 6-minute walk test (6MWT). The 6MWT was administered twice at half-hour intervals. Subjects were instructed to walk on a thirty meter straight area at their own pace for 6 minutes. Before and after the test, oxygen saturation levels, heart rate, blood pressure, fatigue, and dyspnea perception were all recorded. Fatigue and dyspnea perception were evaluated with the Modified Borg Scale. At the end of the test, 6MWT distance was recorded. The long distance value for each patient from the two tests performed was used for analysis (25,26).

Physical activity level

The short form of International Physical Activity Questionnaire was used to determine participants' level of physical activity (24). Turkish validity and reliability was performed by Sağlam et al. (27). The Cronbach alpha coefficient of the Turkish form of the questionnaire was reported as 0.69. Physical activities in the last 7 days are evaluated in the questionnaire. It supplies time and energy consumption records for walking, moderate-intensity, intense exercise, and overall physical activity level. The physical activity level is calculated using the established standard metabolic equivalents (MET) values (27, 28). The number of days people do activities, duration (minutes) and certain MET values of the activities are multiplied and the "MET-minute/week" unit score is obtained. Physical activity levels; It can be classified as inactive (<600 MET-min/Week), minimally active (600-3000 MET-min/Week), or very active (>3000 MET-min/Week) (27, 28).

Anxiety-depression level

Anxiety-depression levels of the participants were determined with the Beck Depression Questionnaire adapted into Turkish by Hisli. (29). The Cronbach Alpha coefficient was found to be 0.80. The participants are asked to select the item that clearly represent how he or she felt in the previous week. Scores for each of the 21 items range from 0 to 3 (30). The total score ranges from 0 to 63. As the total score increases, the severity of depression increases. A score of 0-9 indicates minimal exposure, a score of 10-16 indicates mild exposure, a score of 17-29 indicates moderate exposure, and a score of 30-63 indicates severe exposure (30).

Quality of Life

Quality of life was assessed with the Nottingham Quality of Life Questionnaire (NHP). Turkish validity and reliability was performed by Küçükdeveci et al. Cronbach's alpha coefficients of each subscale were obtained between 0.73 and 0.76. The NHP consists of 38 items and 6 sub-parameters (pain, sleep disturbance, energy, physical activity, emotional reaction social isolation). Each section is measured as follows of 0-100. "0" reflects the best health, while "100" reflects the worst health (31).

Intervention

Nordic Walking exercise training group

The subjects walked outside using specially-designed poles which are attached to the hands via a strap, so the poles can propel themselves forwards (Figure 2). In NWE group, heart rate, blood pressure and oxygen saturation were controlled by the physiotherapist and NWE training was given to the subjects. Before starting the main NWE protocol, the orientation NWE protocol were given to the participants for 1-week. NWE was performed 3 days a week for 15 minutes on the first day, 15 minutes on second day, and 20 minutes on third day in the practice exercise protocol training for 1-week. NWE was performed at 60-80% of the maximum heart rate and subjects' Modified Borg Scale rated dyspnea or fatigue was 4-6 score, 25 minutes in the 1st week, 35 minutes in the 2nd week, by increasing to 45 minutes in the 3.- 6. weeks in the main exercise training protocol. The upper and lower limb stretching, normal joint movement and breathing exercises were performed by participants for 5 minutes before and after the exercise.

Control group

The participants in the control group received no treatment. All subjects were evaluated at the beginning and after 6 weeks.

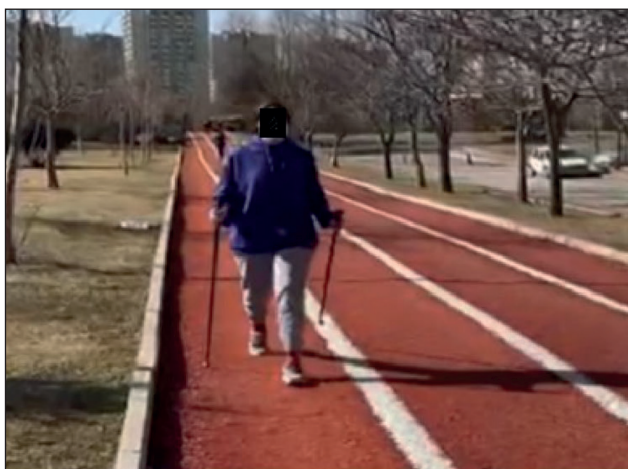


Figure 2: Nordic walking style.

Statistical Analysis

The data obtained in the study was analyzed by using the IBM SPSS version 25 package statistics computer program. Confidence interval was accepted at 95%. Statistical significance level is accepted at $p < 0.05$ value. The median, minimum and maximum values were given for quantitative analysis variables. The frequency and percentage values are given for qualitative variables. The outcomes of the homogeneity (Levene's test) and normality (Shapiro-Wilk) tests were used to determine that statistical methods should be used to make a comparison the research groups. The differences in measurement parameters between two groups were evaluated by the Mann Whitney U Test since the data distribution was nonparametric. The distinction between categorical variables were determined by Chi-square test.

RESULTS

Participants

A total of 30 young adult smokers, 15 subjects in the NWE group and 15 subject in the control group, were included in our study. All exercise training sessions were completed for 6 weeks in the NWE group (Figure 1). The NWE group's minimum age was 22 years, maximum age was 45 years and the control group's minimum age was 21 years, maximum age was 39 years in our study. The NWE group's minimum body mass index (BMI) was 18.30 kg/m², maximum BMI was 28.10 kg/m² and the control group's minimum BMI was 20 kg/m², maximum BMI was 26.30 kg/m². 53.3% of the NWE group were female and 46.6% were male, and 53.3% of the control group was male and 46.6% were female. While the minimum and maximum Fagerström nicotine dependence test scores were 1 and 7 respectively in the NWE group, these were 0 and 6 respectively in the control group. While the cigarette consumption' minimum and maximum values were between 1.40 and 140 pack*years in the NWE group, these were 0.90-196 pack*years in the control group. The demographic and clinical features of the groups were found to have statistically similar ($p > 0.05$) (Table 1).

Comparison of outcome measurement of subjects

When the baseline outcome measurement values of the NWE and control groups were compared, they showed statistically similar characteristics ($p > 0.05$).

Statistically significant improvements were found in the 6-MWT distance ($p = 0.005$), 2-minute step test score ($p = 0.022$), and IPAQ walking ($p = 0.028$) scores in the NWE group after NWE training (Table 2). While the 6-MWT distance ($p = 0.025$), 2-minute step test repetitions ($p = 0.032$), sit and reach ($p = 0.043$) test scores were statistically decreased, the eight foot up-go test score ($p = 0.017$) increased statistically in the control group (Table 2).

Table 1: Descriptive characteristics of subjects.

	NWE Group (n=15) Median (min-max)	Control Group (n=15) Median (min-max)	Z	p ^a
Age (year)	25 (22-45)	23 (21-39)	-1.415	0.157
BMI (kg/m ²)	22.70 (18.30-28.10)	23.60 (20-26.36)	-0.605	0.545
Fagerström Nicotine Dependence Test Score	5 (1-7)	3 (0-6)	-0.693	0.488
Cigarette Consumption (pack*year)	14 (1.40-144)	5.12 (0.90-196)	-0.648	0.543
Gender n (%)			χ^2	p ^b
Female	8 (53.33)	7 (46.66)		0.480
Male	7 (46.66)	8 (53.33)	-0.697	

p < 0.05. **a:** Mann Whitney U Test, **b:** chi-square test, **min:** minimum, **max:** maximum, **BMI:** Body Mass Index.

Table 2: The physical fitness and physical activity level anxiety-depression quality of life scores between nordic walking exercise and control groups.

Outcome Measurements	NWE Group (n=15)			Control Group (n=15)			p ^a	p ^b
	Baseline Median (min-max)	6 Weeks Median (min-max)	p ^a	Baseline Median (min-max)	6 Weeks Median (min-max)	p ^a		
Physical Fitness Parameters								
Chair stand test (repetition)	14.50 (10-20)	16.50 (12-18)	0.383	17.50 (12-25)	16 (11-20)	0.287	0.486	
Arm curl right (repetition)	21 (18-30)	20 (17-25)	0.513	21.50 (13-35)	19.50 (12-27)	0.122	0.761	
Arm curl left (repetition)	20 (18-23)	20 (18-22)	0.507	22 (13-30)	20 (14-25)	0.192	0.801	
2-minutes step test (repetition)	99 (62-121)	102.50 (98-120)	0.022	102.50 (74-112)	100 (77-108)	0.032	0.021	
Sit and reach (cm)	11 (-16-19)	2.58 (-14-19)	0.750	10 (-10-13)	-2.5 (-10-10)	0.043	0.127	
Back scratch right (cm)	3 (0-25)	3 (-4-24)	0.295	0.50 (-7-7)	0 (-12-5.5)	0.201	0.181	
Back scratch left (cm)	0 (-4-24)	2.5 (-4-24)	0.109	0 (-12-2)	0 (-12-5)	0.109	0.181	
8-foot up-go (seconds)	9.75 (7-13)	9 (7-9.5)	0.341	9 (5-10.50)	10 (8-14)	0.017	0.005	
6 minutes walking test distance (meter)	510 (330-660)	600 (470-720)	0.005	552.50 (370-660)	490 (370-540)	0.025	0.006	
Physical activity level								
IPAQ walking score	396 (0-2772)	1113.50 (0-2272)	0.028	313.50 (0-1368)	338.25 (130-1188)	0.735	0.045	
IPAQ moderate activities score	0 (0-1680)	325 (0-1680)	0.204	0 (0-1200)	0 (0-1200)	0.317	0.038	
IPAQ vigorous activities score	0 (0-960)	0 (0-0)	0.180	0 (0-0)	0 (0-0)	0.317	1.000	
IPAQ total score	650 (99-4452)	1449 (396-4452)	0.093	490 (0-1530)	589 (130-1530)	0.735	0.013	
Anxiety- Depression level								
BDS score	6 (0-22)	7.5 (0-18)	1.000	13.50 (4-18)	13.50 (1-22)	0.912	0.496	
Quality of life								
NHP Pain	0 (0-100)	3.5 (0-21.71)	0.465	14.57 (0-58.50)	9 (0-58.50)	0.249	0.188	
NHP Energy	2.5 (0-36.80)	2 (0-36.80)	0.317	4.5 (0-24)	4 (0-63.20)	0.655	0.750	
NHP Emotional reactions	0 (0-12.91)	0 (0-19.36)	0.655	0 (0-36.43)	7.98 (0-36.43)	0.715	0.045	
NHP Sleep disturbance	0 (0-16.10)	0 (0-16.10)	0.590	14.33 (0-77.63)	13.82 (0-77.63)	0.655	0.052	
NHP Social isolation	4.88 (0-33.03)	0 (0-20.13)	0.317	11.96 (0-64.56)	0 (0-42.14)	0.068	0.427	
NHP Physical activity	0 (0-41.37)	0 (0-11.54)	0.317	7.98 (0-42.83)	5.39 (0-42.83)	0.715	0.110	
NHP Total	19.38 (0-196.77)	12.05 (0-102.41)	0.068	90.74 (7.08-269.52)	41.17 (0-269.52)	0.176	0.045	

p < 0.05. **a,b:** Mann Whitney U Test, **min:** minimum, **max:** maximum, **NWE:** Nordic Walking Exercise, **IPAQ:** International Physical Activity Questionnaire, **NHP:** Nottingham Health Profile, **BDS:** Beck Depression Scale, **p^a:** Baseline and after 6 week in groups difference p values. **p^b:** changes in outcome measurement of groups p-values.

When the NWE and control groups were compared at the end of 6 weeks, 6-MWT ($p=0.06$), two-minute step test repetitions ($p=0.021$), 8-foot up-go ($p=0.005$) tests, IPAQ walking ($p=0.045$), IPAQ moderate physical activity intensity ($p=0.038$) and UFAA total scores ($p=0.013$), NHP emotional ($p=0.045$) and NHP total ($p=0.045$) score sub-parameters were statistically different between two groups in favor of the NWE group (Table 2). No statistically significant difference was observed in other outcome measures ($p>0.05$). All outcome measurement values of the subjects are shown in Table 2.

DISCUSSION

The effect of NWE on quality of life, physical activity level, anxiety-depression and physical fitness level in smokers was determined in this study, and this effect was compared to the control group that smoke and sedantary groups. According to our findings, there were improvements in physical activity, quality of life and physical fitness in the NWE group. Since our study is the first randomized controlled study to examine the effectiveness of NWE on the factors listed in smokers, we discussed the results of our study with the NWE applied in other populations in the literature.

The effect of NWE on the level of health-related physical fitness was evaluated with aerobic endurance, muscular endurance, cardiopulmonary endurance, flexibility and balance sub-parameters tests. After NWE, a statistically significant increase was determined in the 6-minute walking test distance and in the two minute step test repetitions. The 6-minute walk test distance, eight foot up-and-go, sit-and-reach and two minute step test scores all decreased statistically significantly in the control group. When the post-research outcome measurements were compared, 6-MWT distance, two-minute step test repetitions, eight foot up and go test results showed statistically significant superiority in the NWE group. All of these results declared that NWE provides improvement in cardiorespiratory fitness and balance sub-parameters of physical fitness. It is possibly reasons that nordic walking uses the oxygen energy system and its coordination-improving movements may have more positive effects on aerobic fitness and balance than flexibility and muscular endurance. However, after nordic walking training, improvement was observed in flexibility, lower and upper extremity endurance tests, but no statistically significant difference was found in these developments. We think that there may be significant improvements in nordic walking training followed for a longer time. We attribute the deterioration the degree of physical fitness in the control group due to the fact that smokers have more sedentary behavior habits during the COVID- 19 pandemic period.

Marciniak et al. determined the effect of 8-week NWE for two times a week with typical poles and poles that included resistance pole on physical fitness in old women.

NWE, using both typical and resistance poles, is useful for old women and improves physical fitness in a short time. However, based on the results of arm curl and two minute step test showing more significant improvement compared to the NWE performed with typical poles, it was determined that the resistance poles provide additional benefit for aerobic endurance and upper extremity muscle strength. In the study, it was emphasized that NWE can be an alternative physical activity method that will contribute to the development of social contact in groups (32).

Prince et al. applied NWE in 77 patients with heart failure for 12 weeks, 2 days a week, and compared its effects with the group that received standard exercise training (11). The outcome measurements of this study were exercise capacity, anxiety-depression, quality of life, body composition, and physical activity level. Similar to our study, in NWE training group, significant increase was determined in the exercise capacity by assessing 6-MWT. However, this increase was similar to the improvement in the standard exercise group. The physical activity levels were evaluated with accelerometry, and no improvement was observed in both groups. The IPAQ questionnaire was used to assess physical activity level in our study, and IPAQ walking scores improved in the NWE group. The NWE group had higher total score scores than the control group. We thought that the deprivation of improvement in physical activity levels in the study of Prince et al. may be due to the heart failure patients with lower functional capacity and also the difference of measurement method. The levels of quality of life were evaluated with a heart failure-specific quality of life questionnaire, and improvement was observed in both groups, and the mental sub-parameter of quality of life was found to be superior in the NWE group (11). In our study, NHP was used to determine quality of life and, similar to the study of Prince et al. no change was observed in both groups after the study. At the end of the study, NHP total and emotional reactions score sub-parameters were different between the two groups in favor of the NWE group. The quality of life scores of our study were similar to the previous research and it was shown that NWE had positive emotional effects. Anxiety-depression levels were evaluated with the Patient Anxiety-Depression Questionnaire, and anxiety-depression levels decreased at a similar rate in both groups in the study of Prince et al. In our study, we evaluated the anxiety-depression level with BDS and we did not observe any differences in either group. We assumed this difference that smoking population had already low BDS score before training.

In another study NWE was applied to perimenopausal women for 4 weeks, 10 sessions, and 60 minutes. Physical fitness was evaluated with the Fullerton test, and similar to our study, they showed that NWE increased the 6-MWT distance, and improved the upper and lower extremity

strength and flexibility of the body. Quality of life was determined by Short Form-36 and it was found that women who participated in NWE showed a significant improvement in both physical and mental health (33).

In a randomized controlled study conducted by Reed et al. the effects of 12 weeks of moderate to severe continuous aerobic exercise, NWE and high-intensity intermittent aerobic exercise were compared in coronary artery disease patients. As a result of the study, positive improvements in physical and mental health were shown in all exercise groups, but it was determined that NWE was clinically and statistically superior to other exercises in functional capacity, which is an important determinant of cardiovascular events. In addition, it was found that all exercises improve the level of depression and quality of life, and it was emphasized that mental health is as important as physical health (34).

In our study conducted with smokers, which is the primary risk factor for cardiovascular and pulmonary diseases, the positive effects of NWE on physical activity level, cardiorespiratory, lower extremity aerobic fitness, balance and quality of life show results consistent with the literature, but no improvement in anxiety and depression levels was achieved. Given this positive effect, NWE can be considered as an alternative method to achieve the desired success in the fight against smoking. Although our study was conducted by experienced physiotherapists with devotion, the lack of long-term follow-up is an important limitation. Changes in our findings of the study that are inconsistent with the previous research can be seen with more cases, long-term exercise training, and the inclusion of comprehensive psychosocial factors in the evaluation. In future studies, we think that the effects of NWE can be examined in samples with different cigarette addictions. In contrast, our study that was first randomized control trial in smokers reveals the strong side of our research.

CONCLUSION

It was concluded that NWE training enhances physical fitness levels, physical activity level, and quality of life in people who smoke, even though it had no significant impact on depression and anxiety symptoms. Based on these findings, NWE may be an effective and alternative exercise approach for increasing physical fitness level, physical activity level, and quality of life in people who smoke, as well as being beneficial in the treatment of smoking cessation. It is thought that NWE can guide rehabilitation programs to reduce the problems that may arise from chronic diseases.

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Author Contributions

Concept: **Manolya Acar**, Design: **Manolya Acar, Nursena Yarımkaaya**, Data collection or processing: **Manolya Acar, Nursena Yarımkaaya**, Analysis or Interpretation: **Manolya Acar, Nursena Yarımkaaya, Mustafa Agah Tekindal**, Literature search: **Manolya Acar, Nursena Yarımkaaya, Mustafa Agah Tekindal**, Writing: **Manolya Acar, Nursena Yarımkaaya, Mustafa Agah Tekindal**, Approval: **Manolya Acar**.

Conflicts of Interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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