SHORT REPORT

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Does health-oriented training improve cardiovascular parameters of smoking women?

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Abstract

Nicotine addiction is a serious medical and societal problem; making smoking cigarettes one of the most prevalent contributors to premature death, globally, and any avenue to facilitate smoking cessation is of vital importance. The aim of this study was to investigate the effect of 6-week health-oriented and/or concentration training programme on cardiovascular parameters and aerobic capacity in 118 young female smokers. This study found that combined health-oriented and concentration training resulted in greater improvements in VO_2max and blood pressure, as compared to concentration training alone; whilst resting values of heart rate (HR) decreased significantly after a 6-week process of aerobic and concentration training. Exercise and concentration training positively influenced smoking cessation and cardiovascular parameters in young females.

KEYWORDS: smoking cessation, aerobic training, concentration training, cardiovascular parameters.

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Introduction

Nicotine abuse is a chronic, recurrent disorder accompanied by smoking cigarettes, in-spite of being aware of their injurious consequences [11]; and is considered a serious medical and societal problem [23]. In existing cigarette smokers even a modest reduction in smoking confers positive health outcomes and safeguards against a premature death [20]. It is estimated that of one billion people, globally, addicted to nicotine, around 70% people are express desire to cease, or ameliorate, their addiction and try to do so using a variety of available methods, which include: pharmacological, behavioural, group and individual therapies, as a mono- or combination-therapy [5]. It is axiomatic that any method of ceasing injurious habitual behaviour is correct if it leads to the achievement of the goal; empirical data suggest comparable effectiveness of anti-smoking counselling and pharmacotherapy, as well as preparations that contain nicotine in their composition [5, 13]. Group therapy is based on elements of health education and operate in therapeutic groups that provide support in overcoming addiction [21]. It allows the exchange of experiences, insights and demonstration of idiosyncratic methods of dealing with different situations [21]; whilst individuals who want to cease smoking can benefit from the experience and support of other participants [21]. Many programmes aimed at stopping smoking, concurrently aim to increase physical activity levels [12, 22]. There is no panacea approach to changing habitual smoking behaviour, however, physical activity should be a fundamental tenet of any programme. Physical activity at any age

promotes the growth of the body's efficiency and ability to perform further work [1, 7]; whilst smoking cigarettes is associated with a decrease in the exercise and functional capacity of the body [9, 19]. Adherence to adequate physical activity levels has been empirically shown to not only reduces psychophysical tension due to stimulation of endorphins and serotonin secretion [6, 8], but is also associated with an increased metabolism of the body and physical efficiency may be restored [3]. Moreover, the energy expended during physical activity can effectively prevent weight gain, an undesirable side-effect for many people who quit smoking [10]. Thus, the aim of the study was to evaluate the effect of 6-week health-oriented and/or concentration training on cardiovascular parameters and aerobic capacity in women smokers.

Material and Methods

Ethics committee

The ethical committee of the Poznan University of Medical Sciences approved the study (Bioethics Committee of the Poznan University of Medical Sciences, no. 534/12 from May 10, 2012). The study complied with the guidelines set out in the Declaration of Helsinki and the ethics policy of the Poznan University School of Physical Education.

Subject recruitment

The study sample comprised 287 female fulltime undergraduate students of cosmetology from the College of Health, Beauty and Education in Poznan, Poland. The participants' mean age was 21 ± 1.68 years. Among 118 female students who were smokers, only 79 (67%) expressed a wish to cease smoking, and 57 (72%) intended to take part in the offered health training programme for smoking cessation. Ultimately, 48 smoking students who fulfilled the selection criteria were randomly divided into two groups and took part in the study. Group 1 (n = 22) consisted of students undertaking concentration training only. Group 2 (n = 26) comprised students undertaking aerobic training and concentration training. Students in each group underwent 6-week, individually adjusted training sessions.

Detailed anthropometric assessment

Prior-to and post completion of the training program, basic anthropometric measurements of body height, body mass and body mass index (BMI) were recorded from all the students (Table 1).

Table 1. Anthropometric characteristics of participants. Baseline of value age, body mass, body height and BMI in women from group 1 and 2

Variable	Group 1 (n = 22)	Group 2 (n = 26)	p-value
Age (yrs)	20.8 ± 2.0	20.4 ± 1.2	0.374
Body mass (kg)	62.3 ± 9.7	59.4 ± 6.0	0.227
Body height (m)	166.5 ± 4.9	166.6 ± 5.8	0.918
BMI (kg/m^2)	22.5 ± 3.4	21.7 ± 1.9	0.201

Concentration training

Women in both groups performed concentration exercises, which were based on training programs for high-performance athletes [16, 17, 18]. Their concentration times were measured twice: prior-to the study and post completion, with a stopwatch, from the beginning of exercise until committing the first error, which in accordance with the accepted research methodology was treated as a sign of lack of concentration. The participants were instructed about the correct execution of concentration exercises so they could perform them on their own, from 7 a.m. to 7 p.m., or 9 a.m. to 9 p.m., for 5 min, every 2 hours. The women from both study groups met twice a week for a joint 60-min concentration training session.

Aerobic training

The participants from group 2 were instructed to choose five out of eight aerobics classes, depending on their interests, preferences, and time availability. A class lasted from 60 to 75 min, while a swimming class lasted 45 min. The weekly training schedule was as follows (Table 2):

Table 2. Weekly training schedule

Day of week	Type of training
Monday	swimming and general fitness training (low-impact aerobics, total body condition (TBC), OVOball)
Tuesday	Hi/Lo aerobic dance, ABT (abdominal, buttocks, thighs)
Wednesday	Pilates or Fit ball
Thursday	Zumba
Friday	body posture exercises
Saturday	jogging or Nordic walking
Sunday	cycling or Nordic walking

The exercises were performed by participants in the same age range (Table 2), but at different physical fitness levels. Due to individual differences in exercise

tolerance between the participants, the instructor chose training loads individually in each class. All participants were informed about movement intensity and chose their physical activities consciously and more effectively.

Assessment of aerobic fitness

The assessment of aerobic fitness was carried out on a cycle ergometer to determine the maximum oxygen capacity (VO_2max) via indirect methods; registering changes in the most important physiological parameters on the basis of heart rate (HR) measurements and the amount of work selected individually for each participant.

Statistical analysis

For all quantitative parameters, normality of distribution was checked using the Shapiro-Wilk test. The significance of mean differences between two terms of measurement in both groups was assessed with an analysis of variance with repeated measures. Tukey's HSD test was used to verify the differences. The Wilcoxon test was used to assess the significance of mean differences, time of concentration training, aerobic training time, and BMI in the entire study sample between two terms of measurement. The level of statistical significance was set at $p < 0.05$. The obtained results were analysed statistically using the Statistica 10.0 software package (Stat-Soft. Inc., USA).

Results and Discussion

Maximal oxygen uptake increased after a six-week training by a magnitude of 2.30 ml/kg/min in group 1

Table 3. Values (mean ± SD) of the maximal oxygen uptake (VO_2max), heart rate (HR), systolic (SBP) and diastolic (DBP) blood pressure in groups in two terms of study

Variable	Group 1 (n = 22)			Group 2 (n = 26)		
	1st term	2nd term	p-value	1st term	2nd term	p-value
VO_2max (ml/kg/ml)	34.93 ± 6.58	37.23 ± 5.67	NS	36.53 ± 5.30	41.01 ± 4.92	0.0002
HR (bpm)	78.8 ± 4.1	76.2 ± 3.8	NS	76.1 ± 5.3	71.4 ± 4.9	0.0525
SBP (mm Hg)	119.2 ± 2.9	117.2 ± 2.6	0.0423	119.7 ± 2.8	118.8 ± 2.3	NS
DBP (mm Hg)	72.3 ± 3.0	69.6 ± 3.0	0.0030	72.4 ± 2.8	69.8 ± 2.7	0.0030

Note: p-value analyzed using Tukey's HSD test.

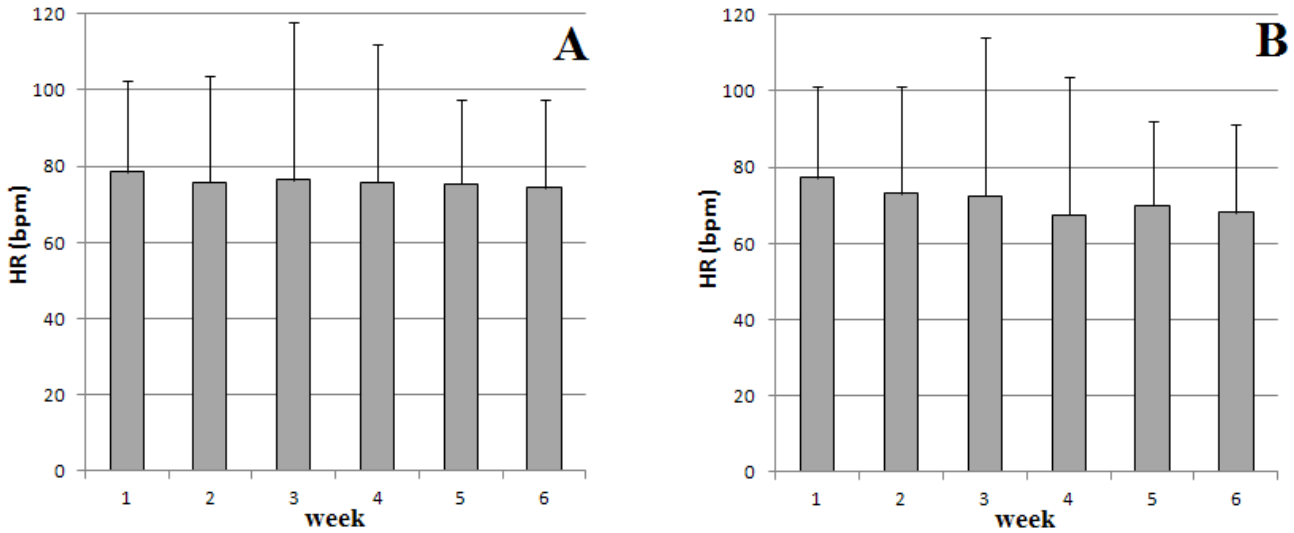
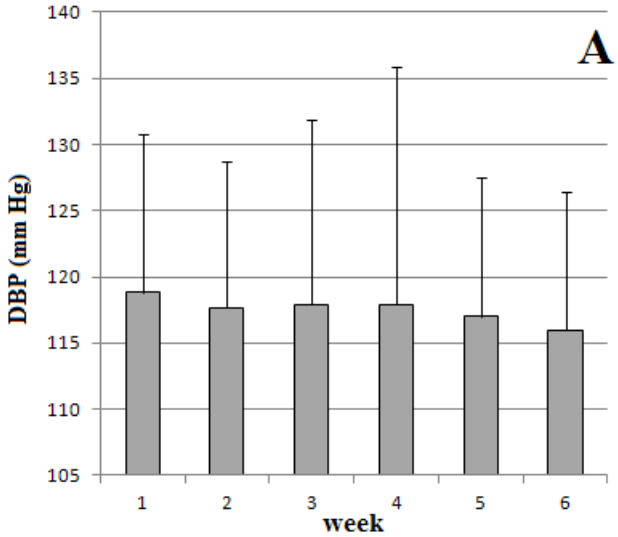


Figure 1. Mean ± SD resting heart rate values (HR) of women from **(A)** group 1 in each research week. A statistical significance was demonstrated between six weeks ($p = 0.0303$; Friedman's ANOVA test). Similarly statistical analysis of the results of resting heart rate in **(B)** group 2 between six weeks of studies showed statistical significance ($p = 0.0316$; Friedman's ANOVA test)

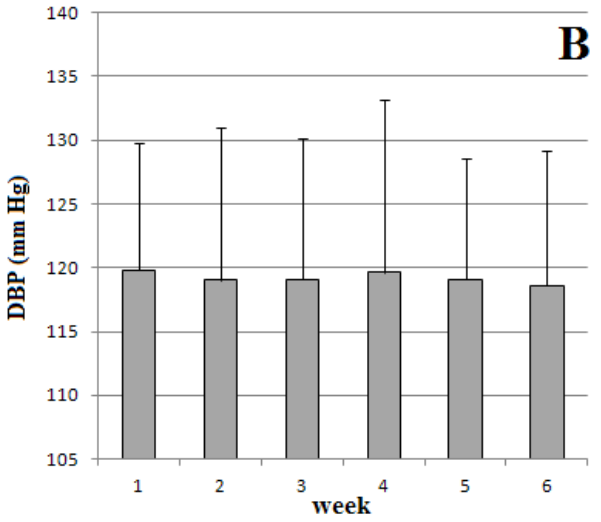
and 4.48 ml/kg/min in group 2. A summary of the mean and SD values of the achieved VO_2max in both groups is presented in Table 3.

The analysis of the daily morning heart rate (HR) measurement showed statistically significant differences in the HR values in both analyzed groups between six weeks of research i.e. group 1 ($p = 0.0302$; Figure 1A) and group 2 ($p = 0.0316$; Figure 1B).

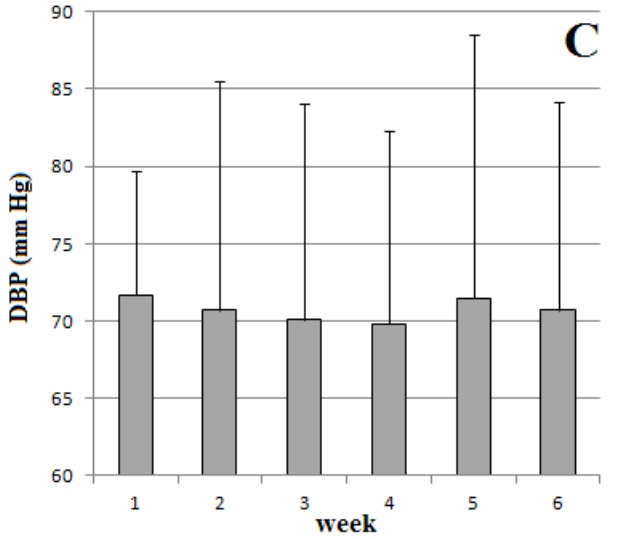
A difference between the mean values of resting HR heart rate was found between week 1 and 6 of



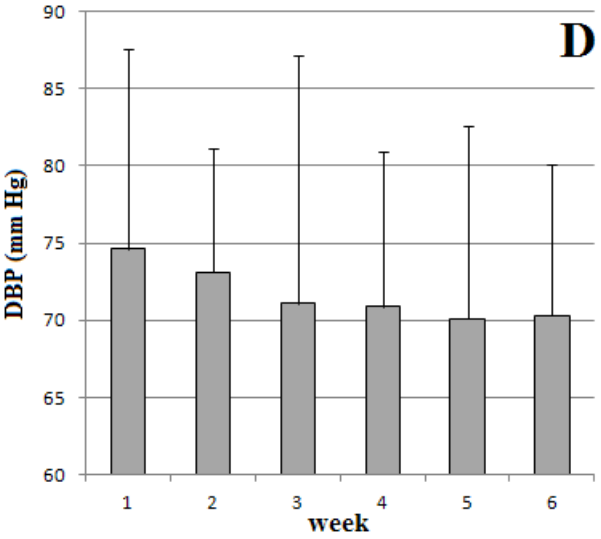
A. Mean ± SD values of systolic blood pressure (SBP) of women from group 1 in each research week. A statistical significance was demonstrated between six weeks ($p = 0.0304$; Friedman's ANOVA test)



B. Mean ± SD values of systolic blood pressure (SBP) of women from group 2 in each research week. No statistical significance was demonstrated between six weeks ($p = 0.4125$; Friedman's ANOVA test)



C. Mean ± SD values of diastolic blood pressure (DBP) of women from group 1 in each research week. A trend for statistical significance was found between six weeks ($p = 0.0904$; Friedman's ANOVA test)



D. Mean ± SD values of diastolic blood pressure (DBP) of women from group 2 in each research week. A statistical significance was demonstrated between six weeks ($p = 0.0349$; Friedman's ANOVA test)

Figure 2. Mean ± SD resting systolic (SBP) blood pressure of women from **(A)** group 1 and **(B)** group 2 in each research week. Mean ± SD resting diastolic (DBP) blood pressure of women from **(C)** group 1 and **(D)** group 2 in each research week

the study in women in both groups. The term 1st was marked as 1 week of testing and the 2nd term as 6 week of testing. Statistical analysis of results in individual groups showed significantly lower ($p < 0.05$) heart rate in women in both groups in term 1 and 2 (Table 3). Rodrigues et al. [15] found in active women, nonlinear periodization strategies of combined training improved cardiovascular health outcomes, which was confirmed in the present study.

The present study analyzed the impact of aerobic and concentration training on blood pressure (BP); systolic and diastolic blood pressure were analyzed between individual study weeks 1 to 6 for groups 1 and 2. The high standard deviation factor (SD) indicates a large variation in BP values in individual participants (Figure 2). The mean values of systolic blood pressure and diastolic blood pressure between the first and sixth week of performed tests were analyzed. The 1st term was marked as 1 week of testing and the 2nd term as 6 weeks. The statistically significant difference in mean systolic blood pressure (SBP) values was found between weeks 1 and 6 of studies in women in group 1 ($p = 0.04$), whilst in group 2, no statistical significance was found. Statistical analysis of diastolic blood pressure (DBP) results between week 1 and 6 showed significantly lower values ($p = 0.003$) in both women in group 1 and group 2 (Table 3). The analysis of changes in body mass revealed that the 6-week training had a significant impact on BMI reduction ($p = 0.008$) among the students participating in aerobic exercises. Among the students of group 1 undertaking concentration training only, BMI remained unchanged, and the differences were statistically non-significant ($p = 0.99$). Similarly, Anderson et al. [4] found that a multimodal intervention (Women's Wellness Program) improved women's cardiovascular risk factors with significant decreases seen in the blood pressure and measured weight.

Conclusions

1. The women who undertaking exercise and concentration training, concomitantly, achieved higher VO_2max values than women who performed concentration training only.
2. Resting values of heart rate (HR) decreased significantly after a 6-week programme of aerobic and concentration training.
3. Aerobic and concentration training, as well as the concentration training itself, reduced diastolic blood pressure (DBP), whilst only adherence to both types of training resulted in a decrease systolic blood pressure (SBP).

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