



## Review Article

# Prescribing Exercise in Tobacco Smoking Cessation Therapy

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## ABSTRACT

Tobacco is one of the main causes of mortality in industrialized countries, yet there is no treatment that is wholly efficacious for helping smokers to quit the habit. Physical exercise is one of the low-cost nonpharmacologic strategies in rehabilitation therapies in several diseases and its practice offers a way of combating the harmful effects of smoking on health. Studies have shown that physical exercise helps reduce the intensity of some of the main symptoms that may arise when a smoker attempts to quit, yet doctors and sport therapists are generally unaware of this benefit and do not know how to prescribe exercise appropriately. This study aims to present the reasons why physical exercise should be considered as a useful nonpharmacologic aid in combatting the symptoms of smoking and smoking cessation, to review the relevant literature, and to outline basic guidelines that might serve to orient the prescription of physical exercise for smokers attempting to quit.

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## Prescripción de ejercicio en el tratamiento de deshabituación del tabaco

## RESUMEN

El tabaco es una de las principales causas de mortalidad en los países industrializados y, sin embargo, no hay ningún tratamiento que sea completamente eficaz a la hora de ayudar a los fumadores a abandonar el hábito. El ejercicio físico es una de las estrategias no farmacológicas de bajo coste que se utilizan en el tratamiento de rehabilitación para varias enfermedades, y su práctica constituye un modo de combatir los efectos perjudiciales del tabaquismo sobre la salud. Los estudios han mostrado que el ejercicio físico ayuda a reducir la intensidad de algunos de los síntomas más importantes a que se enfrenta el fumador cuando intenta abandonar el hábito. No obstante, los médicos y terapeutas del deporte, por lo general, no son conscientes de este beneficio y desconocen cómo prescribir el ejercicio de una forma adecuada. En la presente revisión se pretende presentar las razones por las que el ejercicio físico debe contemplarse como un apoyo no farmacológico y útil para combatir los síntomas del tabaquismo y los relacionados con la deshabituación. Asimismo, se examina la bibliografía pertinente y se esbozan las directrices básicas que pudieran servir de orientación a la hora de prescribir el ejercicio físico a los fumadores que desean deshabituarse.

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## Introduction

Cigarette smoking is a leading cause of premature death in industrialized countries, and although smoking cessation extends life and reduces morbidity, most smokers are unable to achieve this goal.<sup>1</sup> Even though the combination of behavioral support and nicotine replacement therapy has been shown to be effective,<sup>2</sup> other approaches need to be developed to help smokers who are unable to give up the habit.<sup>3</sup>

Physical exercise has been regarded as a useful strategy for smoking cessation, and there is evidence that exercise dramatically reduces craving and withdrawal symptoms among adults.<sup>4</sup> Nevertheless, smokers attempting to quit do not usually receive any counselling on the benefits of exercise from their physicians, who do not know how to prescribe it.<sup>5</sup>

It therefore seems clear that there is a need for greater understanding of why physical exercise should be included in smoking cessation programs, to clarify how exercise may aid smokers who wish to quit and to determine the most favorable type of activity as well as the optimal intensity, duration and frequency that are most beneficial and sustainable for smokers. The aim of this paper is to analyze the most relevant clinical studies on the effects of physical exercise on tobacco smoking cessation and to provide basic guidelines and recommendations for prescribing exercise therapy that can help smokers quit.

## On How Physical Exercise Aids Smokers

There is clinical evidence that physically active smokers live longer than inactive ones,<sup>6</sup> thus the main reason for advising smokers to exercise is that physical activity has a protective effect against some of the main diseases seen in heavy smokers. Smoking has been associated with markedly increased risk for ischemic stroke, myocardial infarction, and aortic aneurysm.<sup>7</sup> Furthermore, in a review of the literature deRuiter and Faulkner<sup>8</sup> found that sedentary smokers are at an even higher risk of cardiovascular disease than physically active ones. They also noted clinical evidence that suggests that active female smokers have more than 30% less risk of coronary heart disease. Smoking has been associated with increases in cholesterol, arterial stiffness and blood pressure,<sup>9</sup> and epidemiological studies have confirmed that these signs of cardiovascular disease can be attenuated by exercise.<sup>10,11</sup>

Similarly, smoking has been identified as an important risk factor for some of the most prevalent types of cancer, and physical activity has been shown to provide some protective effect against them. A reduction in the risk of lung cancer has been observed among highly active smokers.<sup>12,13</sup> Active smokers have been reported to have half the risk of developing colon and rectal cancers,<sup>8</sup> consistent with epidemiological evidence that shows an inverse dose-response association between occupational and recreational physical activity and this type of cancer.<sup>14</sup> They also have a significant reduction in risk for some of the most fatal types of smoking-related cancers, such as endometrial, pancreatic or renal cancers.<sup>8</sup>

Physical activity can also play an important role in the management of acute tobacco withdrawal symptoms. Those suffering from stress, anxiety, changing moods and depression while attempting to quit have been able to reduce the intensity of these symptoms after taking part in various physical activity programs.<sup>15</sup> The nicotine in cigarettes and withdrawal from it can lead to sleep abnormalities,<sup>16</sup> and exercise training has been confirmed as a potential moderator of self-reported sleep disturbance in people attempting to quit.<sup>17</sup> The metabolic effects of nicotine have been shown to be involved in the relation between smoking and lower body weight, so the weight gain that often

follows smoking cessation may be ameliorated, or at least kept under control, by means of exercise.<sup>18</sup> Another important factor relevant to the metabolic effects of smoking is the high concentration of carbon monoxide in tobacco smoke. When inhaled, this gas is transferred to the bloodstream, affecting oxygen transport to the brain and reducing cognitive performance, especially in heavy smokers.<sup>19</sup> Aerobic exercise can counterbalance this effect by improving oxygen supply to the brain, which in turn will lead to better cognitive performance. Moreover, although smoking does not seem to affect activities of daily living it can lead to problems when smokers confront physically demanding tasks<sup>20</sup>; achieving a certain level of fitness is therefore important.

In the case of children and young people smoking has increased in the last decade and although smoking prevention protocols designed specifically for young people are available,<sup>21</sup> physical activity is not generally mentioned. This is the case even though a systematic review has concluded that exercise can discourage smoking initiation and progression, especially in adolescents.<sup>22</sup> One study showed that young people who were physically active reduced their likelihood of initiating tobacco use,<sup>23</sup> a finding that was confirmed by another study in which adolescents in organized sports were less likely to be current smokers.<sup>24</sup>

## On the Effect of Physical Exercise on Smoking Behavior

Two types of reasons are usually given to explain why exercise appears to have a positive effect on quitting smoking. The first type involves neurobiological mechanisms. Nicotine is a substance that engages the reward centers of the brain, targeting the pleasure and reward pathways in the mesolimbic and nucleus accumbens.<sup>25</sup> Animal research has shown that exercise engages the same centers and can compete with addictive substances in order to produce the rewarding effect,<sup>26</sup> which is the trademark of drug addiction. It is possible that in humans, exercise increases dopamine levels, which in turn enhance mood, mimicking the rewarding effect of smoking.<sup>27</sup> Cognitive distraction provides a second set of reasons. It has been suggested that exercise creates a diversion from stressful thoughts and feelings, inducing lower levels of anxiety and reducing smoking withdrawal symptoms.<sup>28</sup> However, when the effect of short moderate-intensity exercise on desire to smoke was compared to the effect of several distraction tasks, the findings suggested that cognitive distraction tasks did not produce the same positive effects on withdrawal symptoms and that the benefits of exercise lasted longer than the duration of the exercise itself.<sup>29</sup> Thus, cognitive distraction seems not be the main link between physical exercise and its beneficial effects on smoking behavior.

## Clinical Studies of the Effect of Exercise on Smoking

Clinical trials assessing the effects of exercise on smoking behavior have been of 3 types. One type has dealt with short-term interventions, designed to analyze the acute effects of exercise on heavy smokers. Others have looked at long-term interventions, which generally include a follow-up phase, aiming to determine if exercise enhances the achievement and maintenance of smoking cessation. Finally, other studies have assessed the efficacy of exercise counselling as an aid for smoking cessation.

### Short-Term Interventions

The acute effects of a short bout of physical exercise on tobacco addiction have been widely investigated<sup>25,27,29,30-32</sup> in studies that all present the same general structure and often report the same results. The sample is composed of sedentary individuals who usually smoke at least 10 cigarettes per day and are required to

completely abstain from smoking for over 15 hours before starting the intervention. Measures (usually, withdrawal symptoms and a desire to smoke) are recorded by means of standardized scales and questionnaires. The exercise intervention usually consists of continuous pedaling or walking for 10 to 20 minutes, at a moderate intensity (40%-60% of heart rate reserve according to the Karvonen formula). Measures are taken just before the intervention, during exercise, just after the effort, and 5 to 20 minutes after completion of the exercise period. Occasionally, an additional measurement is added when the subject is asked to quantify the time between completion of the intervention and the first cigarette smoked after that.<sup>25</sup> The results show that subjects undertaking a relatively short bout of moderate-intensity exercise have a reduced desire to smoke and fewer withdrawal symptoms, both during exercise and up to an hour later, in comparison with control subjects.<sup>31</sup> Moreover, exercise attenuates blood pressure response to stress and to a variety of cues, such as lighting a cigarette, that elicit cigarette cravings. Short periods of moderate intensity exercise should therefore be prescribed as a way of managing craving when smoking cues are present.

#### *Long-Term Interventions*

Several studies have investigated the role of exercise as a healthful alternative to smoking that may facilitate the achievement and maintenance of smoking cessation, since exercise may help individuals cope with some of the withdrawal symptoms (depressed mood, negative effects, stress, and weight gain among others). However, some of these studies have been plagued with methodological problems such as small sample sizes, brief programs, and lack of control over contact time, according to Marcus and coworkers.<sup>33</sup> Thus, there are few quality clinical studies from which strong evidence can be obtained.

In these trials smokers intending to quit are generally assigned to cognitive-behavioral smoking cessation treatment plus exercise or plus equal contact staff time, although some of them have compared the effect of exercise to that of nicotine gum or standard treatment. Even though different therapies are compared, the potential efficacy of all the interventions is usually limited by poor exercise adherence<sup>34</sup>; it is therefore difficult to draw solid conclusions from the findings of these studies.

Generally, interventions for smokers willing to quit use similar approaches, with exercise programs lasting 8 to 12 weeks, containing 1 to 3 sessions per week focused on some kind of aerobic activity and lasting about an hour.<sup>33,35-37</sup> The only differences are the time between the beginning of the exercise intervention and the target date to quit smoking (usually in the middle of the program) and the intensity (moderate or vigorous) of the physical activity prescribed.

The findings of these studies are inconsistent. Some argue that exercise training, especially when combined with cognitive behavioral treatment, increases the rate of successful smoking cessation in comparison to standard treatment, while others state that all groups are equally likely to report smoking cessation at the end of treatment, no matter what type of intervention was used. For instance, although 1 group of researchers found participants who quit and exercised gained less weight in one of their studies,<sup>38</sup> they described another study in which the different interventions were equally likely to prevent weight gain following smoking cessation.<sup>36</sup> Although a systematic review has found it possible to state that smokers who exercise find it less difficult to cope with withdrawal symptoms during and after intervention programs, and that a higher level of exercise participation during the intervention phase is related to a higher likelihood of achieving smoking cessation at the end of treatment,<sup>37</sup> there is still little scientific evidence that exercise aids smoking cessation, and more research is needed.

#### *Interventions Based on Exercise Counseling*

Counseling-based interventions promoting lifestyle-type changes in exercise patterns can result in increased physical activity, and some studies have therefore adopted a more practical, tailored clinical approach than the ones used in the previously mentioned trials. The intention of this type of study is to determine whether adding exercise counseling to a smoking cessation treatment program could improve rates of smoking abstinence.

In this kind of investigation, patients (usually receiving nicotine replacement therapy and behavioral support) are given either health education or brief physical activity counseling, in which they are encouraged to use exercise as a self-control strategy. During the trial (which usually lasts over 2 months), smokers receiving exercise counseling attempt to progress toward 30 minutes of "lifestyle" or more structured exercise on at least 5 days per week, in 10-minute-long bouts.<sup>39</sup> However, despite previous indications that adding exercise counseling can increase the exercise levels of sedentary individuals even in the long-term and also improve some psychological symptoms, it has had no effect on smoking abstinence rates.<sup>40</sup>

#### **Prescribing Physical Exercise for Smokers**

Although little is known about the optimal type, intensity, frequency, and duration of physical activity associated with aiding smokers' attempts to quit, some practical guidelines are suggested by the existing clinical studies of exercise and smoking behavior, as follows.

##### *Type of Activity*

Aerobic lifestyle-type exercise, such as walking, cycling, swimming, or running, should be prescribed first. The effects of muscular or flexibility training on smoking cessation have not yet been studied, with the exception of isometric exercise, which, despite having a potential for offering immediate relief from desire to smoke, has a less pronounced and sustained effect than aerobic activities.<sup>41</sup>

##### *Duration*

Judging by several studies, exercise sessions should be about an hour long, divided into a 5-minute warm-up, 30 to 40 minutes of aerobic activity and a 5-minute cool-down period. However, it must be pointed out that it may be difficult to encourage sedentary smokers to become physically active, so a more practical, tailored clinical approach should be used. For instance, given that fear of weight gain is a main reason why some smokers (especially women) do not succeed in quitting, it is reasonable to encourage them to exercise for at least 20 minutes 7 days a week, advising them to progress towards 60 minutes of continuous daily physical activity.

##### *Intensity*

Although some studies have found vigorous exercise to be efficacious in smoking cessation programs,<sup>36</sup> it may be more appropriate to set lower, more realistic intensity targets in order to make exercise appealing. Moderate-intensity exercise has been shown to provide both greater psychological benefit and have higher adherence rates in comparison with vigorous exercise.<sup>39</sup> Moderate-intensity exercise has been shown to be more effective than light-intensity exercise in reducing withdrawal symptoms, however.<sup>42</sup> Therefore, moderate-intensity activities should be prescribed when adding exercise to a smoking cessation program.

Lifestyle-type activities are also much more appealing and pose fewer adherence problems when they are performed at a moderate intensity.

The prescribed intensity range should be between 40% and 60% of the heart rate reserve when applying the Karvonen method, from 50% to 60% of maximal oxygen consumption, or between 60% and 70% of age-predicted maximal heart rate. However, it must be taken into account that after as few as 11 to 15 hours of abstinence from smoking, the average resting heart rate drops about 8.5 beats/min.<sup>29</sup> The Karvonen method may therefore yield a more appropriate exercise prescription.<sup>33</sup> Moderate exercise has not been shown to be effective among younger smokers, however.<sup>4</sup> In this regard, more research is needed.

### Adherence

The potential efficacy of exercise interventions for smoking cessation is limited by poor adherence, so practical, tailored advice from clinicians prescribing exercise is needed. First, exercise programs should be individualized and based on age, level of fitness, exercise goals and preferences. Second, since group interventions seem to yield better results,<sup>43</sup> smokers willing to quit should exercise in a group and whenever possible sessions should be supervised by professionals, who would provide the required feedback. Third, although most interventions have proposed 3 weekly sessions, such a demanding regimen might be impractical for sedentary smokers. Prescribing 1 or 2 weekly sessions during the first weeks would allow subjects to gradually adjust themselves to the physical demands of an exercise program. Last, it must be taken into account that researchers have recommended sequential rather than simultaneous changes in exercise and smoking behavior to allow the individual to adapt to the demands of the first change of behavior before attempting the next one.<sup>33</sup> In this regard, commencing exercise some weeks before the established target date for quitting smoking could improve adherence.<sup>34</sup>

### Conclusions

It may be concluded that adding supervised physical exercise to behavioral support and nicotine replacement therapy may be useful in the short- and long-term as an aid to maintaining smoking cessation. However, further controlled studies are needed to determine the most appropriate way to prescribe exercise in order to improve adherence and maintain abstinence in the long-term.

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