Preventive Medicine 53 (2011) 172–177

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

The effect on cardiorespiratory fitness after an 8-week period of commuter cycling — A randomized controlled study in adults

Niels Christian Møller [a,*], Lars Østergaard [a], Jens Raaberg Gade [b], Jeppe Lund Nielsen [b], Lars Bo Andersen [a,c]

[a] Centre for Research in Childhood Health, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark
[b] Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark
[c] Department of Sports Medicine, Norwegian School of Sports Sciences, Sognsveien 220, NO-0806 Oslo, Norway

ARTICLE INFO

Available online 25 June 2011

Keywords:
Active commuting
Cardiovascular disease risk factors
Public health
Physical fitness
Physical performance
Body composition

ABSTRACT

Objective. This study investigated the effect of commuter cycling on cardiorespiratory fitness in men and women. Secondary outcomes included body fat and blood pressure measurements.

Methods. In February 2009, 48 volunteers from the Island of Funen, Denmark were randomly assigned to either "no change in lifestyle" or to "minimum 20 minutes of daily commuter cycling during 8 weeks". Maximal oxygen uptake was assessed directly during a progressive cycle-ergometer-test, sum of skinfolds was used as an estimate of body fat, and blood pressure was measured using a Dinamap monitor. Measurements were obtained at baseline and at the conclusion of the 8-week intervention program.

Results. Six cyclists dropped out. After 8 weeks $\dot{V}O_2$max ($mL\ O_2\ min^{-1}$) and cardiorespiratory fitness ($mL\ O_2\ kg^{-1}\ min^{-1}$) were significantly improved in the cycling group when compared to the control group. Delta change in $\dot{V}O_2$max between groups equaled 206 $mL\ O_2\ min^{-1}$ ($p = 0.005$) and delta change in cardiorespiratory fitness equaled 2.6 $mL\ O_2\ kg^{-1}\ min^{-1}$ ($p = 0.003$). Body fatness changed more noticeable ($p = 0.026$) in the cyclists (-12.3 ± 7.3 mm) than in the controls (-0.2 ± 7.1 mm).

Conclusions. $\dot{V}O_2$max and cardiorespiratory fitness were significantly improved and body fat reduced as a result of people engaging in 8 weeks of commuter cycling.

Introduction

A sedentary lifestyle increases the risk of cardiovascular disease (CVD) and mortality (Barengo et al., 2004; Blair et al., 1989; Morris et al., 1953, 1990; NIH Consensus Development Panel on Physical Activity and Cardiovascular Health, 1996; Paffenbarger et al., 1986). Low cardiorespiratory fitness (CRF) associates with atherosclerosis (Rauramaa et al., 1995) and CVD (Lee et al., 1999) and causes increased mortality independent of other risk factors, including body weight (Blair et al., 1996; Wei et al., 1999). Often, lack of time is recognized as an important barrier for increasing the physical activity (PA) level (Trost et al., 2002), and the World Health Organization (WHO) has estimated that up to 60% of the world's population do not meet the recommended PA guidelines of at least 30-min of daily moderate PA (Mackay and Mensah, 2004). Therefore, active commuting compared to leisure time PA appears to be a time-efficient and feasible form of daily exercise which might be appealing to large fractions of the population, including the least active individuals. A health beneficial effect in response to regular cycling has been supported in cohort studies where commuter cycling has been found to reduce all-cause mortality by approximately 30% (Andersen et al., 2000; Matthews et al., 2007). Therefore, commuter cycling could potentially have great public health implications since the greatest health benefits are achieved in the least active individuals (Blair et al., 1989).

In a physiological perspective it has been estimated that regular active commuting has the potential to raise energy expenditure to a level associated with reduced mortality (Shephard, 2008). It is evident that both walking and cycling would contribute to the total PA volume, however, regarding intensity it seems as if particularly bicycle commuting elicits intensities above the threshold of cardiovascular adaptation (de Geus et al., 2007; Hendriksen et al., 2000).

Generally, the evidence linking bicycle commuting with CRF is limited although significant associations previously have been reported in cross sectional and uncontrolled studies conducted in children and adults (Cooper et al., 2006; de Geus et al., 2009; Gordon-Larsen et al., 2009). Previously, randomized controlled trials examining the effect of cycling to work on physical performance have been performed only twice. One of these trials reached its

Abbreviations: CVD, cardiovascular disease; CRF, cardiorespiratory fitness; PA, physical activity; SD, standard deviation of the mean; DBP, diastolic blood pressure; SDP, systolic blood pressure; HR, heart rate; RQ, respiratory quotient.

* Corresponding author. Fax: +45 65 50 34 80.
E-mail address: ncmoller@health.sdu.dk (N.C. Møller).

0091-7435/$ – see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.ypmed.2011.06.007

conclusions based on that participants went commuter cycling for a whole year (Hendriksen et al., 2000), and another trial examined the short term effect in an unspecified subgroup of participants who provided no information regarding representativeness and generalization (Oja et al., 1991). Therefore, the primary objective in the present study was to investigate the short term effect of 8 weeks of commuter cycling on $\dot{V}O_2$max and CRF in a heterogeneous sample of untrained men and women with various occupational affinities. Secondary outcomes were body fat and blood pressure. We hypothesized that a minimum of 20 min of daily commuter cycling in average would lead to a 10% increase in $\dot{V}O_2$max.

Methods

Study participants

Invitations to participate were arranged through the management at 98 companies on the island of Funen, Denmark, if allowed, the leaflets were spread out on the workplace. In the end, participants were recruited from a total of 27 different companies (both industrial and administrative). Generally, the Danish population is one of the most frequently users of the bicycle in the world. However, especially after childhood some stop bicycling at a regular basis.

Subjects were included if they were: 1) at least 18 years old, 2) willing to cycle to work, 3) had not been involved in regular cycling in the last 3 months prior to the intervention, 4) not engaged in regular exercise training (i.e. jogging) or sports in their leisure time, and 5) willing to be randomized to one of the two study groups (i.e. control- or cycling group). Reasons for subject exclusion were suffering from severe cardiovascular- or upper respiratory tract diseases.

Fifty six subjects volunteered to participate. Four subjects were excluded because they were already cycling regularly, one subject withdrew from the study due to a changed work situation, and finally 3 subjects withdrew as they did not want to be assigned to the control group. Subjects finally included were 34 men with a mean age (SD) of 44.3 years (9.4 years) and 14 women with a mean age (SD) of 45.9 years (6.6 years) (Fig. 1). Five subjects were on high blood pressure medication.

Ethical approval for the study was given by the local scientific ethics committee (project-ID: S-20090045) and written informed consent was obtained from all participants.

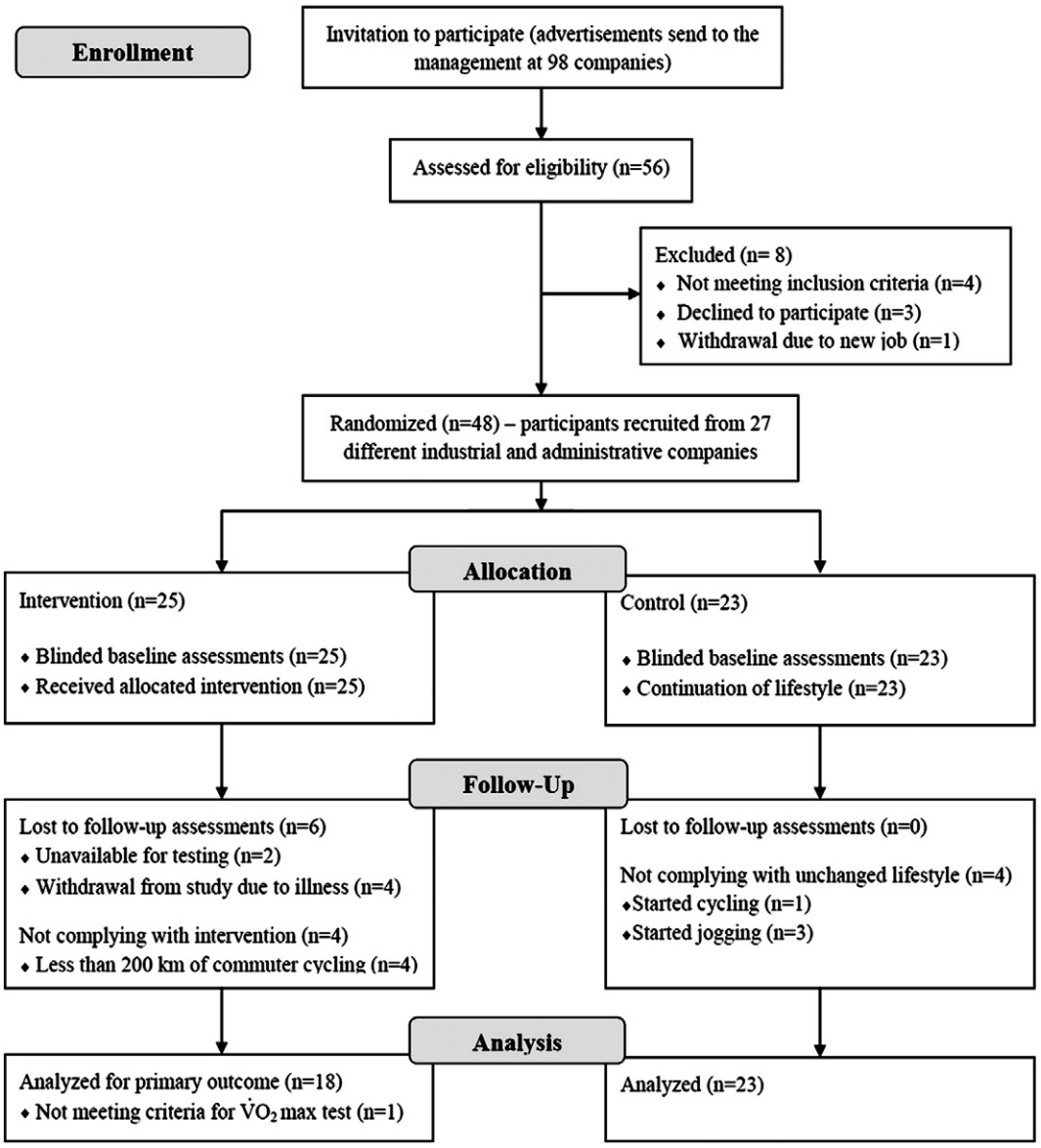

Fig. 1. Participants flow. The study was conducted in Odense, Funen, Denmark from February to April, 2009.