

**Will an aerobic exercise worksite-intervention reduce the relative aerobic workload and other cardiovascular risk factors among workers with high levels of occupational physical activity?
- Results from a cluster-randomized controlled trial among cleaners**

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1. Introduction

Workers with high occupational physical activity suffer from an increased risk of cardiovascular disease (Li et al. 2013). This increased risk has previously been related to the exposure of high relative aerobic workload (Louhevaara 1999; Holtermann et al. 2009). The relative aerobic workload increases when the high level of occupational physical activity is combined with a low cardiorespiratory fitness (Karvonen and Vuorimaa 1988). Therefore, the relative aerobic workload can be attenuated by a reduction of the physical activity or by enhancing the cardiorespiratory fitness (Karvonen and Vuorimaa 1988; Karlqvist et al. 2003; Louhevaara 1999). However, it has been hypothesized, that introducing additional physical activity among workers with high occupational physical activity may overload the cardiovascular system (Krause et al. 2007) due to the limited possibility of restitution (Zock 2005; Søgaard et al. 2006; Louhevaara 1999). Hence, it is not known whether an aerobic exercise worksite-intervention will overload or improve the cardiovascular system among workers with high occupational physical activity (Krause et al. 2007). The literature shows several successful initiatives for enhancing the cardiorespiratory fitness among workers with high occupational physical activity (Proper et al. 2003) but none has, to our knowledge, evaluated the effect on relative aerobic workload. Cleaners constitute the target population because they are exposed to high levels of occupational physical activity (Louhevaara 1999; Krüger et al. 1997; Korshøj et al. 2013), have a low cardiorespiratory fitness (Krüger et al. 1997; Korshøj et al. 2013), and suffer from an increased risk for cardiovascular disease (Sjögren et al. 2003; Zöller et al. 2012). Therefore, the present study aimed to investigate whether aerobic exercise will reduce the relative aerobic workload and other risk factors for cardiovascular disease in a RCT worksite-intervention among cleaners.

2. Method

116 cleaners between 18-65 years were randomized to either a reference (n = 59) or an aerobic exercise group (n = 57). The reference group received lectures (2 times 2-h during the 16-week period) and the aerobic exercise group performed worksite aerobic exercise (30 min twice a week for 16 weeks) at an intensity of ≥ 60 % of the heart rate reserve (% HRR). Data were collected at baseline and after 16 weeks, including measurements of cardiorespiratory fitness by a sub-maximal step test, resting blood pressure and resting heart rate at health examinations at the worksite, and diurnal heart rate for measuring relative aerobic workload (% HRR), and sleeping heart rate by 4 x 24-h measurements with the Actiheart monitor (The Actiheart web site 2014). A repeated-measure 2 x 2 multi-adjusted mixed-models design was applied to compare the between-group differences in an intention to treat analysis.

3. Results

In comparison with the reference group, the aerobic exercise group showed beneficial effects of the intervention on all outcomes except systolic blood pressure. The between-group analysis of differences pre-post intervention showed that the intervention enhanced the cardiorespiratory fitness by $2.2 \pm 0.8 \text{ mL O}_2 \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ (95 % CI 0.6, 3.8, $p < 0.01$); reduced the relative aerobic workload by 3.3 ± 1.2 % HRR (95 % CI - 5.8, - 0.9, $p < 0.01$); decreased the resting heart rate with 3.8 ± 1.2 bpm (95 % CI - 6.1, - 1.4, $p < 0.01$); decreased the sleeping heart rate with 3.9 ± 1.0 bpm (95 % CI - 6.0, - 1.8, $p < 0.01$); and increased the systolic blood pressure by 3.6 ± 1.2 mmHg (95 % CI 1.1, 6.1, $p < 0.01$) in the aerobic exercise group. No between-group difference was seen for diastolic blood pressure.

4. Discussion

These results indicate that an aerobic exercise worksite-intervention among cleaners leads to a reduced aerobic workload, and an enhanced cardiorespiratory fitness. To our knowledge, this is the first study showing a reduced relative aerobic workload from an aerobic exercise worksite-intervention. These findings emphasise that it is possible to increase the cardiorespiratory capacity and to lower the relative aerobic workload. Also, resting heart rate and sleeping heart rate were lowered suggesting an attenuated cardiovascular risk, but surprisingly resting systolic blood pressure increased. Thus, the aerobic exercise worksite-intervention seems to induce several beneficial cardiovascular physiological effects, potentially reducing the cardiovascular risk, but also one negative effect. This study is based on a cluster-randomized design and objective heart rate data, but as ambulatory blood pressure is superior to resting blood pressure in prediction of cardiovascular risk (Hansen et al. 2007) future analysis should employ ambulatory blood pressure measures. In conclusion, the present study shows that the aerobic exercise worksite-intervention reduced the relative aerobic workload, and enhanced the cardiorespiratory fitness. Nevertheless, the findings emphasize the need of analysis of more comprehensive data on blood pressure before recommendations with respect to aerobic exercise for workers with high occupational physical activity can be given. In addition, when addressing workers with high occupational physical activity their blood pressure should be monitored closely to avoid imposing a potential cardiovascular overload.

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