Brief Original Report

The association between physical activity, cardiorespiratory fitness and self-rated health

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ABSTRACT

Objective. To investigate the joint association between self-reported physical activity as well as cardiorespiratory fitness and self-rated health among healthy women and men.

Method. Data from 10,416 participants in The Danish Health Examination Survey 2007–2008 which took part in 13 Danish municipalities were analyzed. Leisure time physical activity level and self-rated health were based on self-reported questionnaire data. Optimal self-rated health was defined as “very good” or “good” self-rated health. Cardiorespiratory fitness (mL O₂·min⁻¹·kg⁻¹) was estimated from maximal power output in a maximal cycle exercise test.

Results. A strong dose–response relation between cardiorespiratory fitness and self-rated health as well as between physical activity level and self-rated health among both women and men was found. Within categories of physical activity, odds ratios for optimal self-rated health increased with increasing categories of cardiorespiratory fitness, and vice versa. Hence, participants who were moderately/vigorously physically active and had a high cardiorespiratory fitness had the highest odds ratio for optimal self-rated health compared with sedentary participants with low cardiorespiratory fitness (odds ratio = 12.2, 95% confidence interval: 9.3–16.1).

Conclusion. Although reluctant to conclude on causality, this study suggests that an active lifestyle as well as good cardiorespiratory fitness probably increase self-rated health.

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Introduction

Self-reported physical activity and cardiorespiratory fitness, that is the capacity to transport and utilize oxygen, are associated with lower incidence of cardiovascular diseases and all-cause mortality (Kodama et al., 2009; Li and Siegrist, 2012; Nocon et al., 2008). Regular physical activity of moderate and high intensity is associated with improved cardiorespiratory activity of moderate and high intensity is associated with improved cardiorespiratory fitness and self-rated health, Prev. Med. 48 (2009) – 1711–1718.

Self-rated health is a strong predictor of disease and mortality and thought to be a valid proxy for the current health state of the individual (DeSalvo et al., 2005; Idler and Benyamini, 1997; Möller et al., 1996). Studies have found that physically active individuals rate their health to be better than inactive individuals (Bize et al., 2007; Galán et al., 2010; Häkkinen et al., 2010). It is unknown if this finding is due to being physically active in itself or due to the effect of performing physical activity on cardiorespiratory fitness (Häkkinen et al., 2010; Kaplan et al., 1996). The aim of the present study was to investigate the joint association between physical activity as well as cardiorespiratory fitness and self-rated health among healthy women and men.

Material and methods

We analyzed cross-sectional data from The Danish Health Examination Survey 2007–2008 (DANHES 2007–2008). The study invited a random sample of 180,103 adults (18 + years) from 13 Danish municipalities with a total of 18,065 participating in the health examination (Eriksen et al., 2011). From this population, we studied 10,416 individuals who underwent a maximal exercise test after exclusion for heart- or lung-related disease, chest pain, hypertension, consumption of counter indicating medication, pregnancy, or any serious muscular/skeletal/joint problem. Participants provided informed consent and the protocol was reviewed by the Scientific Ethical Committee B for the Capital Region of Denmark (H-B-2007-050).

We estimated cardiorespiratory fitness from a maximal progressive cycle exercise test (Ergomedic 839E, Monark Exercise AB, Vansbro, Sweden) continued until volitional exertion. Cardiorespiratory fitness was estimated indirectly from maximal power output (watt) obtained by participants in the maximal cycle test (Andersen, 1995). We included cardiorespiratory fitness (mL O₂·min⁻¹·kg⁻¹) in the analyses as gender and age specific tertiles or quintiles. Physical activity (within the last year) in leisure time was reported by the participants in a questionnaire with four response categories: Sedentary (reading, watching television or other sedentary activities), light (walking, bicycling, or other light activities >4 h per week), moderate (recreational sports and heavy gardening >4 h per week), and vigorous activity (strenuous exercise and gardening >4 h per week).
competitive sports several times per week). Physical activity was included in the analyses with all four categories or three categories (moderate and vigorous joint in one category due to the relatively small number of vigorously active participants). Participants were asked to rate their current state of health in response categories of “very good”, “good”, “fair”, “poor”, and “very poor”. We defined optimal self-rated health as “very good” or “good” self-rated health.

We estimated odds ratios (OR) for optimal self-rated health by logistic regression adjusted for gender, age, educational level, body mass index (BMI), smoking status, and frequency of meeting friends and family using STATA 12 (StataCorp LP, Texas, USA). To account for potential nonparticipation bias, we applied weights based on register information from Statistics Denmark on gender, age, civil status, and income for all participants who were invited but did not show up at the examination (Statistics Denmark, 2009).

Results

Physically active participants more often had optimal self-rated health compared to less active and sedentary participants, and participants with a high level of cardiorespiratory fitness more often had optimal self-rated health compared to participants with a lower level of cardiorespiratory fitness (Table 1).

Within categories of physical activity, ORs for optimal self-rated health increased with increasing categories of cardiorespiratory fitness, and vice versa (Fig. 1). Hence, participants who were moderately/vigorously physically active and had a high cardiorespiratory fitness had the highest OR for optimal self-rated health compared with sedentary participants with low cardiorespiratory fitness (OR = 12.2, 95% CI: 9.3–16.1). Analyzing the data separately for men and women led to a similar association (data not shown).

Discussion

We found a strong dose–response relation between cardiorespiratory fitness and self-rated health as well as between physical activity level and self-rated health among both women and men. The higher the category of cardiorespiratory fitness or physical activity, the higher the odds for optimal self-rated health. Furthermore, the OR for optimal self-rated health increased with increasing categories of cardiorespiratory fitness irrespective of physical activity category.

Our results support the existing knowledge about a positive association between physical activity and self-rated health. Hakkinen et al. (2010) found a positive association between physical activity as well as a physical fitness index (including cardiorespiratory fitness) and self-rated health among 727 young male reservists. They mentioned that a positive association between cardiorespiratory fitness and self-rated health was found, but data was not shown. Thus, it is difficult to compare the results with ours.

<table>
<thead>
<tr>
<th>Cardiorespiratory fitness</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>815</td>
<td>1077</td>
</tr>
<tr>
<td>Low</td>
<td>856</td>
<td>1159</td>
</tr>
<tr>
<td>Medium</td>
<td>890</td>
<td>1215</td>
</tr>
<tr>
<td>High</td>
<td>910</td>
<td>1285</td>
</tr>
<tr>
<td>Very high</td>
<td>899</td>
<td>1310</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>440</td>
<td>542</td>
</tr>
<tr>
<td>Light</td>
<td>2053</td>
<td>3695</td>
</tr>
<tr>
<td>Moderate</td>
<td>1596</td>
<td>1653</td>
</tr>
<tr>
<td>Vigorous</td>
<td>272</td>
<td>156</td>
</tr>
</tbody>
</table>

Table 1 Odds ratios (OR) and 95% confidence intervals (CI) for optimal self-rated health in men (N = 4370) and in women (N = 6046), according to cardiorespiratory fitness and physical activity level* (Denmark 2007–2008).

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Conflict of interest statement

The authors declare that there are no conflicts of interest.

Kaplan et al. (1996) found a higher cardiorespiratory fitness among healthy participants with good perceived health compared to those with average or bad perceived health. The association was substantially weaker in the healthy participants compared to the association found in the entire study population including the less healthy group of participants. In order to reduce such potential bias in our analyses, we only included individuals who were free of, for example, cardiovascular disease. Analyzing this healthy population limited the risk of our results being a reflection of underlying disease.

A strength in our study was the large population and the wide variation in all measures. Nevertheless, the low participation in DANHES 2007–2008, along with our further selection of the participants who were able to undergo a maximal exercise test, limited the generalizability of our results to healthy adult individuals. In our study physical activity level was based on self-report in four categories. Objective measures of physical activity compared with subjective measures has shown relatively better health-related quality of life (Anokye et al., 2012), indicating that our results may have been underestimated. The fact that data were cross-sectional precluded any strong conclusion on causality. It is plausible that increased cardiorespiratory fitness has improved self-rated health but it is also likely that individuals with optimal self-rated health have tended to improve their cardiorespiratory fitness by being physically active as self-rated health could be a motivator for being physically active. A combination of these two possible causal explanations may have constituted a positive circle with physical activity improving self-rated health and cardiorespiratory fitness which again has led to physical activity being maintained or improved.

Self-rated health is not an ‘either or’ phenomenon but rather a continuous measure. However, for the purposes of illustration and for comparison with other studies we chose to include self-rated health as a dichotomized variable defining optimal self-rated health corresponding to the categories “good” or “very good”. We conducted sensitivity analyses with an alternate cut-point in the dichotomization of self-rated defining optimal self-rated health as “very good” and repeated the main analyses. Tendencies in these results were similar to the results obtained with the original dichotomization. This shows that the cut-point in itself is not driving the results.

Although reluctant to conclude on causality, this study suggests that an active lifestyle as well as good cardiorespiratory fitness increase self-rated health.
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**References**


