UMEÅ UNIVERSITET

Umeå University Medical Dissertations, New Series No 2201

Physical Activity, Visceral Adipose Tissue, and Cardiovascular Disease in Older Adults
- Associations and Effects

Marcel Ballin

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Aula Biologica, Biologihuset, fredagen den 2 juni, kl. 09:00.

Avhandlingen kommer att försvaras på svenska.

Fakultetsopponent: Professor, Maria Hagströmer
Institutionen för Neurobiologi, vårdvetenskap och samhälle, Sektionen för fysioterapi, Karolinska Institutet, Stockholm, Sverige

Institutionen för samhällsmedicin och rehabilitering, Enheten för Geriatrik

Organization
Umeå University
Department of Community Medicine and Rehabilitation, Geriatric Medicine

Document type
Doctoral thesis

Date of publication
12 May 2023

Author
Marcel Ballin

Title
Physical Activity, Visceral Adipose Tissue, and Cardiovascular Disease in Older Adults – Associations And Effects

Abstract
BACKGROUND: Cardiovascular disease (CVD) is the leading cause of mortality in older adults. With the population aging rapidly, interventions aimed at improving modifiable risk factors for CVD, such as physical inactivity and visceral obesity, could play an important role in reducing its burden, provided they are proven effective.
AIMS: To investigate the associations of objectively measured physical activity of different intensities and visceral adipose tissue (VAT) with the risk of CVD and all-cause mortality, to investigate the effects of structured physical activity (exercise) on VAT, and to review the effects of exercise on CVD and all-cause mortality based on evidence from randomized controlled trials (RCTs).
METHODS: This thesis comprised two cohort studies, one RCT, and one narrative review of evidence from RCTs. The cohort studies included about 3,300 older adults with baseline data on physical activity and VAT mass, as obtained using accelerometry and dual-energy X-ray absorptiometry, respectively. Cases of stroke, myocardial infarction, and all-cause mortality during follow-up were collected from Swedish nationwide registers. The RCT included 77 men and women aged 70 years with visceral obesity who were randomly allocated to either 10 weeks of supervised vigorous-intensity exercise or to no exercise, with VAT mass measured before and after the intervention. In the review, evidence from RCTs and meta-analyses of RCTs on the effect of exercise on CVD (N=19,162) and all-cause mortality (N=37,443) in general older adults and in individuals with chronic conditions (such as obesity, type 2 diabetes, and preexisting CVD) were reviewed.
MAIN FINDINGS: Greater amounts of physical activity of any intensity, but especially that of at least moderate intensity, were associated with lower risk of stroke, myocardial infarction, and all-cause mortality. Conversely, greater VAT mass was associated with higher risk of stroke or myocardial infarction. In the RCT, short-term vigorous-intensity exercise seemed to decrease VAT mass slightly, but the effect was not statistically significant. Finally, the review showed that there is currently no convincing evidence from RCTs that exercise effectively reduces the risk of CVD or all-cause mortality, which is in sharp contrast to the strong associations typically reported in conventional observational studies. The reasons for the conflicting findings are likely complex and multifactorial. In the RCTs, a lack of statistical power could partly explain why no effects have been detected in the general population of older adults, but it is unlikely to explain the null findings in clinical populations, as some of these trials, including meta-analyses of such trials, have been large. Other potential explanations could be a ceiling effect due to the inclusion of participants who were healthier and more physically active than the general population, or that an effect of exercise was masked by the use of effective medications such as antihypertensives and lipid-lowering agents. On the other hand, observational studies have likely overestimated the benefits of physical activity, because these studies are vulnerable to selection bias, reverse causation, and unmeasured confounding, such as from heritable influences.
CONCLUSIONS AND IMPLICATIONS: Despite strong associations, the protective effect of physical activity as a single intervention against CVD and all-cause mortality in older adults is probably not as substantial as is commonly presumed. To uncover the true role of physical activity in preventing CVD, further high-quality trials would be valuable. However, because these trials are very difficult and resource demanding, they should be complemented by innovative observational studies that seek to strengthen causal inference through addressing sources of bias and confounding that are often incompletely accounted for in conventional observational studies. This could include a variety of methodologies, such as utilizing negative control outcomes, instrumental variables, sibling comparisons, and other genetically informed designs. As the aging population continues to grow, it becomes increasingly important to take these scientific steps in order to provide a more definitive answer to the question of the extent to which physical activity alone can reduce the risk of CVD.

Keywords
physical activity, exercise, obesity, stroke, myocardial infarction, death, aging, geriatrics, epidemiology, trial

Language
English

ISBN
print: 978-91-7855-893-3
pdf: 978-91-7855-894-0

ISSN
0346-6612

Number of pages
117 + 4 papers