Movement Behaviors and Cognitive Health for Office Workers

av

Emil Bojsen-Møller

Akademisk avhandling

Avhandling för doktorsexamen i idrottsvetenskap
vid Gymnastik- och idrottshögskolan,
som enligt beslut av rektor kommer försvaras offentligt
fredagen den 18 mars 2022 klockan 9:00,
i Aulan, vid Gymnastik- och idrottshögskolan, GIH, Stockholm.

Opponent: PhD Teresa Liu-Ambrose
University of British Columbia, Canada
Abstract:

The lifetime trajectories of movement behavior and cognitive functioning depend on complex interactions between genetic and environmental factors. There is substantial evidence suggesting that physical activity benefits cognitive functions. However, how sedentary behavior and the composition of movement behaviors (i.e., sleep, physical activity, and sedentary behavior) influences cognitive functions remains to be elucidated.

Observational studies suggest that sedentary time is unfavorably related to cognitive functions in older adults, but the majority of evidence comes from self-reported estimates of movement behavior, which are rather weakly related to device-based measures. Furthermore, while evidence suggests that structured exercise can have protective effects on cognition in inactive older adults, much less is known about how midlife movement behavior is related to cognitive functions. Thus, knowledge of how midlife movement behavior relates to and possibly affects cognitive functions and its underlying mechanisms is much needed.

This thesis is part of a larger research project investigating how movement behaviors relate to and influence cognitive function, mental health, and neurophysiological mechanisms underpinning these. The project specifically targets healthy office workers and is co-produced with employers of office workers and health-promoting companies. This thesis aimed to investigate how movement behaviors relate to and influence cognitive functions and neuroplasticity among office workers.

The first study investigated cross-sectional relationships between device-measured movement behavior and cognitive functions among 334 office workers. The results revealed no association between total time spent in moderate to vigorous physical activity or sedentary behavior and cognitive functions, suggesting that this association may not be as robust as previously suggested in older populations or as inferred from self-report.

The second study investigated the extent to which corticospinal excitability is influenced by different movement behaviors. Sixteen sedentary office workers participated in a cross-over randomized controlled trial. We contrasted 3 hours of prolonged sitting with 3 hours of interrupted sitting and 2.5 hours sitting followed by a 25-minute bout of exercise. Acute changes in corticospinal excitability and long-term potentiation-like neuroplasticity were investigated using transcranial magnetic stimulation and paired associative stimulation. Changes in corticospinal excitability over time did not differ between conditions, suggesting that in inactive middle-aged office workers, a physical activity bout or frequently breaking up prolonged sitting does not induce immediate changes in corticospinal excitability or long-term potentiation-like neuroplasticity.

The third and fourth studies are based on a 6-month cluster-randomized intervention conducted in 263 healthy office workers. An ecological model for behavior change was used to design two interventions aiming at reducing sedentary behavior or increasing physical activity relative to a passive control group, with the ultimate aim of improving cognitive functions and mental health. The third study investigated how effective each intervention was at changing the 24-hour movement behaviors. Sixteen sedentary office workers participated in a cross-over randomized controlled trial. We contrasted 3 hours of prolonged sitting with 3 hours of interrupted sitting and 2.5 hours sitting followed by a 25-minute bout of exercise. Acute changes in corticospinal excitability and long-term potentiation-like neuroplasticity were investigated using transcranial magnetic stimulation and paired associative stimulation. Changes in corticospinal excitability over time did not differ between conditions, suggesting that in inactive middle-aged office workers, a physical activity bout or frequently breaking up prolonged sitting does not induce immediate changes in corticospinal excitability or long-term potentiation-like neuroplasticity.

In summary, the results presented in this thesis did not provide support for an association between movement behaviors and cognitive functions in healthy physically active office workers, demonstrated no acute effect of a single session of physical activity or breaking up prolonged sitting on corticospinal excitability in sedentary office workers, and revealed no evidence for successful movement behavior change or benefits for cognition in an ecological cluster-randomized intervention in healthy physically active office workers. The findings suggest that among physically active office workers, sedentary behavior may not be as detrimental for cognition and neuroplasticity as previously suggested and shows that changing movement behavior in office workers at the workplace represents a challenging endeavor. Still, these findings do not exclude the possibility that changes in movement behaviors might benefit cognitive functions in physically inactive office workers at higher cardiovascular risk, with lower cardiorespiratory fitness and/or lower daily cognitive stimulation.

Keywords: Movement behavior, Physical activity, Sedentary behavior, cognitive functions, neuroplasticity

ISBN: 978-91-986490-4-8
http://urn.kb.se/resolve?urn=urn:nbn:se:gih:diva-6966

Emil Bojsen-Møller, Gymnastik- och idrottsforskolan, Lidingövägen 1, Box 5626, SE-114 86 Stockholm, Sweden, e-mail: emil.bojesen@gih.se