



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكرو فيلم

# بسم الله الرحمن الرحيم



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التوثيق الإلكتروني والميكروفيلم



## شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

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# **Effect of Balance Training Versus Stretching Relaxation Exercise in Memory and Spatial Cognition Enhancement on Healthy Adults**

**Thesis**

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in Audio-Vestibular Medicine*

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# قَالَ

سَبَّحَانَكَ لَا إِلَهَ إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ  
الْعَلِيمُ الْعَظِيمُ

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## *List of Abbreviations*

Abb.	Full term
BESS .....	Balance Error Scoring System
BVC .....	Boundary vector cell
COPD.....	Chronic Obstructive Pulmonary Disease
CRF.....	Cardiorespiratory fitness
EFs.....	Executive functions
ERP.....	Event-related potential
GOLD .....	Global Initiative on Obstructive Lung Disease
HD cell.....	Head direction cell
HPC .....	Hippocampus
LTM.....	Long Term Memory
MEC.....	Medial entorhinal cortex
MMF .....	Mismatch field
MMN .....	Mismatch negativity
MST .....	Medial superior temporal area
OED .....	Oxford English Dictionary
ParaHPC .....	Parahippocampal cortex
Parietal Ant.....	Parietal anterior cortex
PIVC .....	Parieto-insular vestibular cortex
PNF .....	Proprioceptive neuromuscular facilitation
PNS.....	Parasympathetic nervous system
RSP .....	Retrosplenial cortex
SNS.....	Sympathetic nervous system
SSC .....	Stretch-shortening cycles
STM .....	Short Term Memory

## *List of Abbreviations Cont...*

Abb.	Full term
VIP.....	Ventral intraparietal area
WAIS .....	Wechsler Adult Intelligence Scale
WM .....	Working memory

# INTRODUCTION

Physical exercise has been shown to improve cognitive functions. However, it is still unknown which type of exercise affects cognition. In the present study, we tested the hypothesis that a demanding balance training program improves memory and spatial cognition.

Developing methods to enhance neuroplasticity and cognitive functioning has become a major research interest of psychologists in the light of quickly advancing technologies and aging societies (*Lindenberger, 2014*).

Among a large variety of behavioral interventions such as cognitive training programs and special nutrition, physical exercise programs have been suggested to improve cognition (*Hötting and Röder, 2013; Erickson et al., 2015*).

Physical exercise over a course of several months has been shown to improve cognitive performance, including executive functions, speed of processing and memory. Moreover, aerobic exercise has been found to slow down gray matter volume loss in the hippocampus and frontal lobes (*Kramer et al., 1999; Voelcker-Rehage et al., 2011*).

So far, most of the studies investigating the effects of physical exercise on cognitive functions have focused on aerobic training like running, walking and cycling. However, a recent meta-analysis on the effects of aerobic training on cognitive functions in older adults

concluded that there is still no clear evidence for a causal link between an increase in cardiorespiratory fitness and cognitive benefits (*Young et al., 2015*).

Thus, cardiorespiratory fitness improvements following aerobic training might only be one of multiple factors mediating the positive effects of exercise on cognition. This hypothesis is supported by recent reports suggesting beneficial effects of other types of exercise on cognitive functions. For example, randomized controlled intervention studies employing coordination training (*Voelcker-Rehage et al., 2011; Moreau et al., 2015*).

Moreover, dancing reported positive effects on memory, selective attention, executive functions and spatial cognition compared to control groups (*Kattenstroth et al., 2013*).

Physical exercise, regardless of its aerobic or anaerobic metabolic demands, provides a stimulus to vestibular, neuromuscular and proprioceptive systems. The perception of self-motion and balance is coded by vestibular detection of inertial motion, in conjunction with proprioceptive and visual signals (*Angelaki and Cullen, 2008*).

Connections between vestibular nuclei and the cerebellum, hippocampus, as well as prefrontal and parietal cortices provide information for cognitive functions such as spatial functions, navigation and memory (*Hitier et al., 2014*).



It has been speculated that an increased stimulation of the vestibular system during self-motion might be an essential mediator between physical exercise and cognitive functioning (*Smith et al., 2010*).

However, data on the effects of balance training on cognitive functions as they are related to memory and spatial cognition are not clear, indeed, the goal of the present study is to test the hypothesis that a physical exercise program with high demands on the vestibular system could improve memory and spatial cognition.