

# PHYSICAL ACTIVITY IMPROVES THE COGNITIVE FUNCTION AMONG ELDERLY: AN INTEGRATED LITERATURE REVIEW

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## ABSTRACT

One of the most feared aspects of increasing age is cognitive decline. The physical activity had a decline of 20% with growing age. Some literature showed that the effects of physical activity on the cognition of health are still contradictory. The purpose of this study is to present the relation between physical activity and cognitive function among the elderly through methods of Integrated Literature Review (ILR), to ensure that the physical activity could prevent the cognitive decline in the elderly. This reviews searches relevant articles through EBSCO, Proquest and Cengage for studies with a quantitative method. The result shows that physical activities are related to increasing the cognition of the elderly. Walking is one of the physical activities which are related to increasing the cognitive function of the elderly. Walking is a simple physical activity that is effective and less costly. Thus, it can be concluded that Physical activity is important in preventing elderly cognitive. They perform physical activity according to their ability consistently. Physical activity is necessary for the elderly to enhance their condition and ability. They need to consider appropriate physical activities for their wellbeing. It is recommended that cognitive enhancement is not only prioritized for the elderly who are still able to carry out activities but also those who experience physical disability.

**Keywords:** *Physical Activity, Elderly Cognitive, Aging Population*

## INTRODUCTION

The rate of ageing population is increasing dramatically throughout the world. By 2050, the age group above 60 years is estimated to reach 2 billion. In Japan, 30% of the population is over 60 years old, while in China it is estimated that there will be nearly 120 million in this group, and 434 million people worldwide (WHO, 2018a).

The UN (2017) reported that people aged 60 years and over in developing regions between 2017 and 2050 are expected to increase from 652 million to 1.7 billion in 2050, while more developed regions are projected to increase 38%, from 310 million to 427 million. Projections show that by 2050, 79% of the world's population aged 60 or over will live in developing regions.

One of the most feared aspects of increasing age is cognitive decline. Cognitive decline or damage is a major health and social problem that occurs in an

increasingly ageing population, worldwide. In the UK, cognitive failure was the cause of acceptance for institutional care with a percentage of 40% (Deary, *et al.* 2009). Cognitive change can affect a person's ability to carry out routine activities, such as driving, taking care of personal finances, and following medical prescriptions (Hailu, 2015)

In general, cognitive ageing refers to the decline in age associated with one's "fluid intelligence", which is the ability to think logically, and find solutions to new problems. Cognition of a person will undergo changes over time, and this will occur in all individuals during their lifespan that is not explained by either neurological and psychiatric disorders (Hailu, 2015).

WHO (2018b) recommends that for cognitive decline occur among people with age above 65 years. As a result, they must do physical activity according to their conditions and abilities, such as physical activities of their leisure time, transportation (walking or cycling), work (if individuals are still involved in work.

Williams & Kemper, (2010) reported that energy expenditure calculated for activities carried out at ages 70 to 81 years experienced a decline in cognitive measurements over time. They reported the highest activity level resulted in 20% risk reduction for cognitive decline. While the results of the research conducted by Yaffe, Barnes & Nevitt (2001) reported that there is no association between physical activities that could reduce cognitive decline among 327 elderly men and women.

Some literature showed that the effects of physical activity on the elderly in reducing cognitive decline are still contradictory. Scherder *et al.*, (2005) in his research showed that the effects of activity, measured directly in elderly with mild cognitive impairment (MCI). After treatment, there was improvement of cognitive function in general or in Executive Function (EF). The results showed that in the two treatment groups (walking group and hand/face group) significant improvements were presented in tasks relating to EF than that of the control group. Scherder *et al.*, (2005) stressed that the effectiveness of mild physical activity in EF among the elderly can only be taken after studies with more subjects.

The aim of this study is integrative literature review on all published studies related to physical activity in cognitive enhancement among the elderly with the following objectives:

- a. To present a review of studies that address relationship between physical activity and cognitive enhancement in the elderly,

- B. To observe physical activities that is performed mostly by the elderly.

This study uses methods of Integrated Literature Review (ILR) to determine that physical activity could reduce the cognitive decline among the elderly.

**RESEARCH METHODOLOGY**

An Integrated Literature Review (ILR) was performed. Proquest, EBSCO, and Cengage library were searched for (21<sup>st</sup> of October 2005 through 21<sup>st</sup> October 2018) with the use of the terms “Elderly Cognitive” and “Physical Activity”.

**Inclusion and exclusion criteria**

Published articles that meet the following criteria are chosen for inclusion: in English, the participants are elderly people over the age of 55 years, the study uses physical activity to reduce cognitive decline in the elderly. Studies focused on elderly cognitive and physical activity. If duplicate studies are identified, only the most recent studies are included. Only studies published as full - text articles were included during the examination. If the published study was found irrelevant the present review after reading the entire manuscript, they were excluded.

**Data extraction**

For each study, the following general information was extracted: language, author, year of publication, full text available, detail about the subject, and the method used. Detail data extracted specifically is shown in the following figure 1:

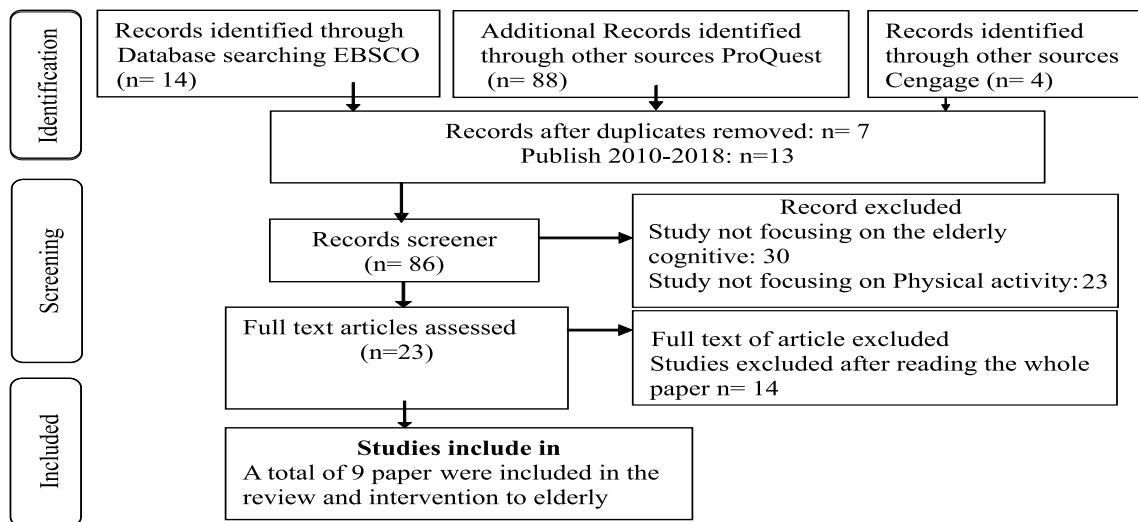


Figure 1: Flow diagram of the reviewing process according to PRISMA

## RESULTS

This study uses a quantitative method with a cross-sectional design approach. These studies included were conducted in the United States, Japan, England, Switzerland, Taiwan, the Netherlands and Germany. They investigated the relationship between physical activities in reducing cognitive decline in the elderly.

Chang *et al.*, (2011) showed that the elderly who attend Tai Chi (TC) sessions regularly tend to have better Digit Span scores than those with low attendance rates. This result allowed that Tai Chi has some impact on cognitive stages. Elderly people who skip Tai Chi (TC) activities tend to experience a decline in cognitive function. The results of this study found that TC had some impact on global cognitive function (MMSE) and psychomotor/cognitive processing speed (Digit Symbol-Coding), without regard (Stroop Color and Word test and Digit Span) and memory (Hopkins Verbal Learning Test-Revision). This study uses a small number of samples, so that it is not strong enough to detect the effects of Tai Chi (TC) on specific cognitive function.

Muller's research (2017) Chan and Myers (2017) showed a strong association between physical fitness and the development of cognitive disorders. The activity provides a beneficial effect on cognitive function Physical fitness and physical activity are exercises that help stimulate neurogenesis in the hippocampus, increase the volume of grey and white matter in the prefrontal and temporal cortical regions, which are thought to be types of cognitive activities. Exercise helps to increase blood flow and supply oxygen to these areas. Exercise also helps channel brain-derived growth factors and neurotrophic factors. These factors reduce extracellular amyloid- $\beta$  plaques that are thought to be the cause of other diseases and cognitive disorders (Muller, Chan & Myers, 2017).

Nemoto *et al.*, (2018) stated that Subjective Cognitive Complaints (SCC) can be prevented through higher physical activity and prolonged mentally active sedentary behaviour. However, the high activity cannot be carried out by elderly people who experience poor cognitive function as a result of SCC. He concluded that the risk of SCC can be minimized by high physical activity or lengthy and active mental activities. The

effects of a combination of higher physical activity and cognitive active behaviour can be seen from the low risk of SCC among adults living in the community.

Falek *et al.*, (2017) found that lack of physical activity and sedentary behaviour resulted in MCI among the elderly than the elderly without MCI. Moreover, the relationship between physical activity and sedentary behaviour with cognitive functions was different from the possibility of MCI status.

The exercise can stimulate temporal lobe activation to improve physical function and prevent elderly people from experiencing disability in the future. He also found increased activity in the additional motor area and prefrontal cortex after 3 months, which illustrates the compensatory strategy in adults, while observing the relative increase in regional glucose metabolism in the left premotor and supplementary motor area, left and right somatosensory association cortex, and the right primary visual cortex (Shimada *et al.*, 2017).

Eggenberger *et al.*, (2017) in their study showed about every third (35.6%) of older people at the age of 70-79 and nearly three-quarters (73.8%) of 80-year-olds cannot walk faster than 1.2 m / sec, what is needed to cross the road safely in the yellow-green traffic light signal phase, under conditions that are cognitively challenging (speed dual-task walking). He stated that the fitness status of the elderly is not enough to maintain their independence related to their daily mobility and their safety in urban areas. Behaviour development is needed to improve cognitive and physical fitness among the elderly. Slow walking speed is a major cause of problems and modifications that need to be improved mainly through strengths and other training modalities, while cognitive performance, attention components can be increased through aerobic and other training modes, or the latest combination of activities which is more promising is the cognitive-physical training approach.

Hsieh *et al.*, (2018) revealed weakness and cognitive impairment as reciprocal relationships that can affect each other in the Subjective Cognitive Decline (SCD) stage. Elderly people have poorer performance on cognitive function or physical measurement because of functional impairments, which was assessed by their Activity of Daily Living score is less than 60 (ADL<60) or their Instrumental Activities of Daily Living (IADL)

score is less than 6 (<6).

In addition, weakness is mostly related to cardiovascular disease (for example, stroke), which can cause vascular dementia and affect cognitive and physical function. The results of their study explained the significant relationship between subjective cognitive decline and frailty among the elderly. The subjective cognitive decline is positively related to pre-frailty or frailty.

Blankevoort *et al.*, (2013) showed that significant predictors of cognitive performance for men and women were accessible through muscle strength. In men, performance can be predicted by walking ability and balance, while in women it can only be measured by walking ability. The results of their research proved there is a significant relationship between cognitive and physical performance, with gender moderation effects.

Research conducted by Etgen *et al.*, (2010) found that there was a significant relationship between lacks of physical activity against incident cognitive damage. These results remained statistically significant even after adjusting for potential confounders including age, sex, basic cognitive status, depression, chronic kidney disease, and cardiovascular risk factors. based on the latest meta-analysis it was found from 16 prospective studies with 163797 participants without dementia (initial) and 3219 cases of dementia (at follow-up). It was found that the highest physical activity reduced the relative risk of dementia.

## DISCUSSION

### 1. Physical Activities Related to Prevent Cognitive Decline in the Elderly

This literature review found that physical activity was a key factor that could potentially improve cognitive ageing. The basic data and clinical data from the study used a quantitative method with a cross-sectional design approach. Based on the trials of interventions that had been conducted it was found that exercise and physical activity had a positive effect on cognition.

The fundamental physiological mechanisms explained about the influence of physical activity on cognition, where high and moderate intensity activities significantly increase blood flow to the brain and

provided an increased supply of nutrients needed (Gligoroska & Manchevska, 2012).

This result is appropriate with the research of Gligoroska & Manchevska, (2012). They showed that the expression of neurotrophic factors is increased by long-term physical exercise. A neurotrophic factor may also have an effect in the brain. The neurotrophic factor is accountable for neuron genesis, their viability and struggle to stress, which all together ease the learning process (Gligoroska & Manchevska, 2012). Neurotrophic factor has also been revealed in the hippocampus, the brain region which is directly embroiled in learning (Gligoroska & Manchevska, 2012). Thus, prolonged physical exercise increases the expression of neurotrophic factors. This may likewise have a neurogenerative and neuroprotective effect in the brain, which could be exerted by stimulation of new cells growth and development and by the protection of neurons from ischemic damages.

Ehlers *et al.*, (2018) examined in his findings that there is a correlation between exercise, neural mechanisms, and cognitive function. He explained that there is a causal pathway from exercise to brain structure and functions for cognitive function. He added that based on the results of the literature it was found that there was a causal relationship between physical activity and brain structure and function.

In this study, results were obtained that physical activity can help to prevent cognitive decline in the elderly. However, based on the literature studies, this research is mostly conducted in advanced countries, while in developing countries it is limited.

### 2. The Activities that Often Used by the Elderly

Based on nine literature found, activities that are often carried out by the elderly in preventing their cognitive decline are physical activities that includes: Tai Chi, treadmill exercise, reading, television viewing, physical activity, activity non-specific, aerobic exercise, walking exercises that are carried out including walking fast, but the most physical activity that commonly used by the elderly is walking.

Ohman *et al.*, (2014) stated that commonly, the activity that was often practiced by older adults with mild cognitive impairment or dementia is walking, Tai

Chi, dancing and combine with training that increased strength was aerobic training. A high intensity and a good adherence with long duration of the intervention seem to essential for positive outcome.

Büla (2016) stated that walking is an activity which can prevent the decline of cognitive strength. Walking activity is a simple activity, easy to do, and cost-effective interventions. He also stated that aerobic exercise is a physical activity that can be done by the elderly which has the strongest potential to improve cognition.

These results are in alignment with the research of Carvalho *et al.*, (2018) that showed the significant correlation between physical activity and cognitive decline. This provided the significant benefit from the physical exercise such as; aerobic exercise with a bicycle ergometer or treadmill in a population of female elderly. He explained that long-term aerobic exercise has the benefit of reducing the effects of the sedentary vascular disease. Carvalho *et al.*, (2018) stated that exercise increases the role of neurotransmitters, effect of neurotrophin and cerebral blood vessels. Moreover, Carvalho *et al.*, (2018) added this process can weaken neurodegeneration, and provide neuroprotective benefits, to produce better cognitive function.

This literature merely reviews the physical activity for the elderly who still have the ability to do an exercise or physical movement, or with a certain disease but still have the ability to do exercise. It does not include the

elderly who has a physical disability.

### 3. Limitation of this review

The limitation of this study is that published studies are mostly from advanced countries, such as United States, Germany, Netherlands, Switzerland, British, Japan, and Taiwan, while research studies in developing countries do not exist. This study is limited to the physical activity of the elderly without looking at the other factors such as gender, the weight and lightness of activities, accompanying diseases experienced by the elderly. Thus, further review work is necessary based on these factors on the ability of elderly activities related towards the prevention in the decline of cognitive function.

### CONCLUSION AND RECOMMENDATION

The integrated review provides a summary of the relationship between physical activities and cognitive performance in the elderly. Physical activity is important for preventing elderly cognitive decline. They can continue their physical activity consistently according to their ability. Physical activity is necessary for the elderly considering their condition and ability, especially in the elderly with special needs or disabilities. They need to consider appropriate physical activities in their daily routine. Physical activity is recommended not only for the elderly who have cognitive decline but for the elderly who still have a good cognitive function.

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