



Physical Activity and Healthy Ageing

The Positive Effect of Physical Activity on an Ageing Population

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BS Thesis

Sports & Health-Science



HÁSKÓLI ÍSLANDS
MENNTAVÍSINDASVIÐ

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Final Thesis in Sports & Health Science

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Sports & Health Science
Menntavísindasvið Háskóla Íslands
June 2019

Physical Activity & Cognitive Health

Ritgerð þessi er 5 eininga lokaverkefni til BS-prófs
í Íþróttá- og Heilsufræði við Heilsuefling, Íþróttá og Tómsunda deild,
Menntavísindasviði Háskóla Íslands

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Abstract

Due to demographic changes, of decrease in mortality and increase in natality, the nowadays older adults' population, is growing, and estimated to grow even larger in the future. This community of older adults, faces problems which affect both the individual and society as a whole (World Health Organization., 2015). These problems, of socioeconomic nature, need solutions which public healthcare systems have not been able to solve in an efficient manner (Bouchard, Blair, & Haskell, 2012; Gudlaugsson, 2018). This literature review, explores "what positive effects does physical activity have on older adults and how can it enhance healthy ageing?". To answer these questions, the process of ageing is firstly divided into physical, cognitive and psychological dimensions (Jeste, Depp, & Vahia, 2010; Pruchno, Wilson-Genderson, Rose, & Cartwright, 2010). Secondly, finding evidence on how physical activity can provide an effective help or prevention for the decline of each one of these dimensions. Amongst many positive results it is suggested that, physical activity augments blood circulation, which has positive effects on proper functioning of the body both physically and cognitively (Churchill et al., 2002; Gudlaugsson et al., 2013). It stimulates proper functioning of the brain, in having to adapt to the physically active enhanced-movements and spatial awareness (Hötting & Röder, 2013). Physical activity also helps the body release endorphins which contribute to more positive mood levels (Spirduso, Francis, & MacRae, 2005). Studies suggest that, group physical activity, despite being of low-intensity, increases positive emotional well-being and, lowers risk of depressive symptoms (Kritz-Silverstein, Barrett-Connor, & Corbeau, 2001). Overall it can be said that Physical activity has positive effects on all three dimensions, especially alongside or accompanied by cognitive and social stimulation. (Hötting & Röder, 2013; Podewils & Guallar, 2006).

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Foreword

My interest for this topic arouses from both personal experience, as well as future plans regarding a MS in Public Health. I am convinced that it is crucial to explore physiological as well as psychological aspects when finding long-term health solutions. Moreover, my grandmother's passing due to dementia made me reflect on the fact that, no matter how fulfilling your life was, nothing matters if your here and now is not predominantly satisfying.

I would like to thank in first place my tutor, Milan Chang, who's professional ambition as well as personal thrive in this area of research I consider deeply inspiring. My boyfriend Stefán Pálsson, for your joy, support and patience. My mother, who has taught me to have vision and meaning in life. To Háskóla Íslands, for this wonderful 3 year-journey, Takk fyrir mig. And this is, but the beginning. I look forward to participating in further research.

Þetta lokaverkefni er samið af mér undirritaðri. Ég hef kynnt mér *Síðareglur Háskóla Íslands* (2003, 7. nóvember, <http://www.hi.is/is/skolinn/sidareglur>) og fylgt þeim samkvæmt bestu vitund. Ég vísa til alls efnis sem ég hef sótt til annarra eða fyrri eigin verka, hvort sem um er að ræða ábendingar, myndir, efni eða orðalag. Ég þakka öllum sem lagt hafa mér lið með einum eða öðrum hætti en ber sjálf ábyrgð á því sem missagt kann að vera. Þetta staðfesti ég með undirskrift minni.

Reykjavík, 10. Maí 2019

Ana Geppert

1 Introduction

Our modern world is facing demographic changes that have a vast impact on a social and economic level (Allegri et al., 2007; Wimo et al., 2017). With an increasing natality, in our society, along with an increasing older adult generation the demographical balance has been reshaped (World Health Organization., 2015).

The ageing population is a worldwide issue that affects the individual and society, as a whole, on a global scale (Allegri et al., 2007; Wimo et al., 2017). As it is expected, demographic trends in ageing will continue to rise which will result the older population to reach 72.1 million (19% of the total) by the year 2030 (World Health Organization., 2015). It would be a twofold increase of the older population in 2000 (Beard, Officer, de Carvalho, et al., 2016; Beard, Officer, & Cassels, 2016; Spirduso et al., 2005; World Health Organization., 2015).

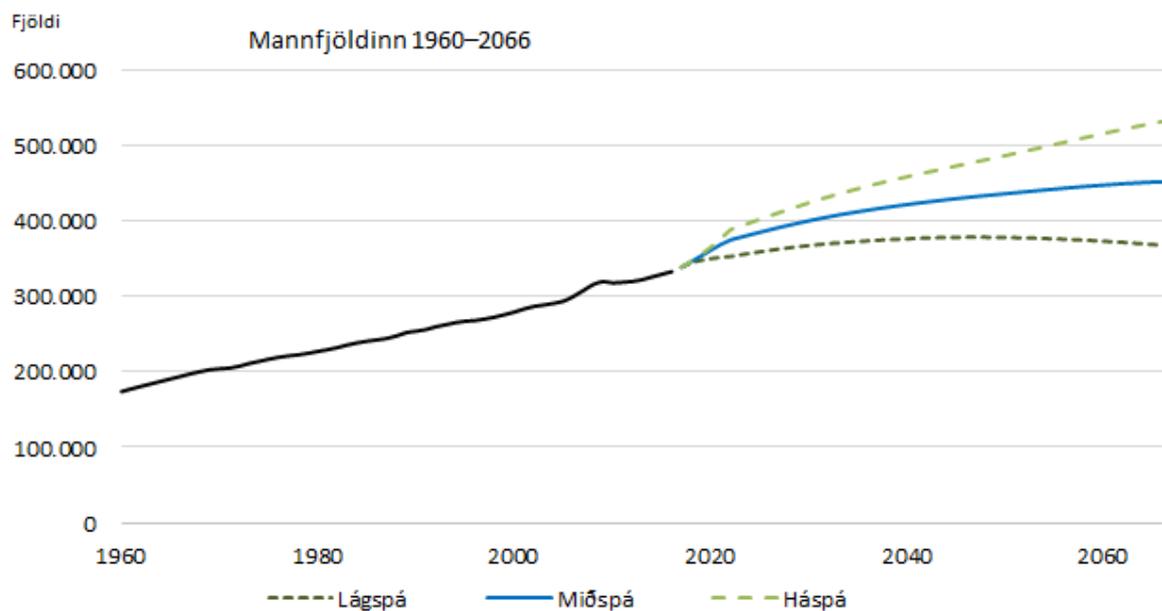


Figure 1. Estimated population in Iceland 1960-2066 (Hagstofa Íslands., 2019)

Improvement in public health and health care, with advances in areas such as sanitation immunizations and improved nutrition, enables the population worldwide to live longer (World Health Organization., 2015). Therefore, it is important to understand how the ageing process works, in altering human health and functioning, distinguishing which of these alterations in function are reversible and which are not (Bouchard et al., 2012; Gudlaugsson, 2018). This would provide an important future direction to improve quality of life for an increasing older population (Gudlaugsson, 2018).

Age-related cognitive decline, dementia, physical impairment, and depressive symptoms are strongly related to quality of life among ageing population (Bishop, Lu, & Yankner, 2010). This decline makes the increasing number of older adults a great burden to society (Jönsson & Wimo, 2009). Those conditions translated into high costs for individuals well as for the government because they need either formal or informal care in society (McCarthy, 2013; Wimo et al., 2017). It is therefore crucial to find long-term solutions and effective way to prevent the physical, cognitive, and psychological consequences, which come along with the increasing ageing population (Jönsson & Wimo, 2009; McCarthy, 2013). One of the most effective ways to prevent or delay dementia could be physical activity (Bouchard et al., 2012; Brett, Stapley, Meedya, & Traynor, 2019; Lara et al., 2013; Spirduso et al., 2005).

According to Icelandic research, there has been 66% reduction in cases of Myocardial infarction which is estimated to have caused an 80% reduction in death rate (European Commission. Directorate-General for Employment Social Affairs and Inclusion., 2012; Gudlaugsson, 2018). Ageing, and the growth of an older adult population, should be seen as an achievement instead of a threat (World Health Organization., 2015). Therefore, it is our duty to improve the process of ageing, in the present and near future (European Commission. Directorate-General for Employment Social Affairs and Inclusion., 2012).

1.1 Definitions

Ageing: “Biologically, results from the impact of the accumulation of a wide variety of molecular and cellular damage that occurs over time” (World Health Organization., 2015).

Dementia: “Syndrome in which there is deterioration in memory, thinking, behavior and the ability to perform everyday activities. Although dementia mainly affects older adults, it is not a normal part of ageing. Alzheimer’s disease is the most common form of dementia” (World Health Organization., 2019).

Health: “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”(World Health Organization., 2015)

Healthy ageing: “The process of developing and maintaining the functional ability that enables well-being in older age.” (World Health Organization., 2015)

Impairment: “A loss or abnormality in body structure or physiological function (including mental functions).”(World Health Organization., 2015)

Life expectancy: “The average number of years of life remaining for a population of individuals, all of the same age, usually expressed from birth as the average number of years that newborns might expect to live.” (Spirduso et al., 2005; World Health Organization., 2015)

Longevity: “The length people live” (World Health Organization., 2015).

Morbidity: The absence of health, and all too frequently it is a condition in which many frail older adults, live for a long time before they die (Spirduso et al., 2005).

Older person: “A person whose age has passed the median life expectancy at birth. ” (World Health Organization., 2015)

Successful ageing: A multi-dimensional process integrating physical, cognitive, emotional, and social functioning. Subjective definitions include maintenance of goals, positive attitudes toward the self and future, and attainment of social milestones and connectedness. Whilst objective definitions emphasize freedom from disease and disability (Jeste et al., 2010).

Well-being: A general term encompassing the total universe of human life domains, including physical, mental and social aspects, that make up what can be called a “good life”. (World Health Organization., 2015)

2 Demographic changes and ageing

2.1 Ageing, health and functioning

The average life-expectancy is longer and therefore a growing proportion of the population will be older adults (World Health Organization., 2015).

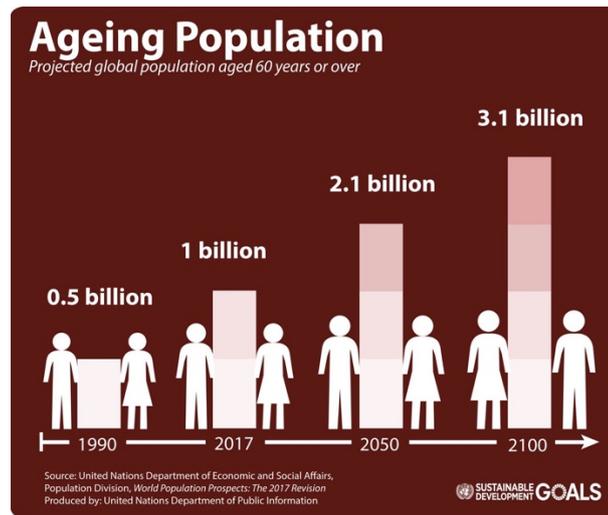


Figure 2. World Population Prospects: Ageing Population (United Nations., 2017)

The overall physical decline through ageing occurs by accumulation of an intramolecular and cellular deterioration accumulated by time (Hebert et al., 2015; Penninx et al., 2009). It happens gradually over time which increases risk for multiple age-related diseases (Penninx et al., 2009). However, physical and health status differs a lot between individuals, which are strongly influenced by the environment and lifestyles of each individual (Stephens, Szabó, Allen, & Alpass, 2018; Woo, 2000). In this increased longevity, health is the essential factor which will provide more freedom and opportunities (Gudlaugsson, 2018; Xu et al., 2018). However, the consequences can be notably negative, when these added years are mostly with reduced abilities, and take place in environments which make it difficult to keep a healthy-lifestyle (Chrysikou, Rabnett, & Tziraki, 2016). Both for the older adult and for society, it is, therefore, crucial to provide an environment to promote a lifestyle that strengthens both physical, and mental health (Chrysikou et al., 2016). The solutions suggested and provided for an ageing population have not been successful until now (Beard, Officer, & Cassels, 2016; World Health Organization., 2015).

Current health-systems are not well equipped to provide the care for an ageing population (Bergman, Johansson, Lundberg, & Spagnolo, 2016). Number of older adults who need nursing and social care is expected to increase (Jönsson & Wimo, 2009). It further leads to a high

demand of institutionalized health-care jobs, such as nurses (Poot, 2018) as well as the private care-taking of older adults at home (Bergman et al., 2016). Sustainable and long-term solutions need to consider the physical, cognitive and psychological aspect for older adults (Lara et al., 2013; World Health Organization., 2015). The concept of healthy ageing phenotype (HAP) was suggested by Lara et al. (2013). The HAP concept is characterized by physiological and metabolic health, physical capabilities, cognitive function, social wellbeing and psychological wellbeing. It is a useful outcome measurement in intervention studies for older adults (Lara et al., 2013).

There are various reasons why we need to reinforce well-being for ageing population. Primarily, it is a human right embodied in international law. Older adults have the right to the most optimal obtainable standard of health (World Health Organization., 2015). Demographic transitions must be considered when developing a sustainable health plan for the future (Allegri et al., 2007). Lastly, the current healthcare systems are not economically feasible for an increasing older adult population (McCarthy, 2013). Therefore, resources that contribute to long-term solutions must be provided (World Health Organization., 2015).

2.2 Ageing and quality of life

The process of ageing is mainly categorized by three dimensions: physiological, cognitive and psychological, which were named “Physical condition, functional status and subjective health” by Spirduso (2005). Being able to function properly physically, mentally, and socially is a key factor for quality of life (Xu et al., 2018), as well as an absence of disease and pain (World Health Organization., 2015). Furthermore, healthy ageing means maintaining physical abilities to perform everyday individual necessities, maintaining autonomy and independence (Xu et al., 2018). Cognitive health is also essential to maintain quality of life. It provides the capability to manage his/her own finances, social interaction, as well as intellectual and creative fulfillment for older adults (Spirduso et al., 2005; World Health Organization., 2015).

Fig. 2.4. A public-health framework for *Healthy Ageing*: opportunities for public-health action across the life course

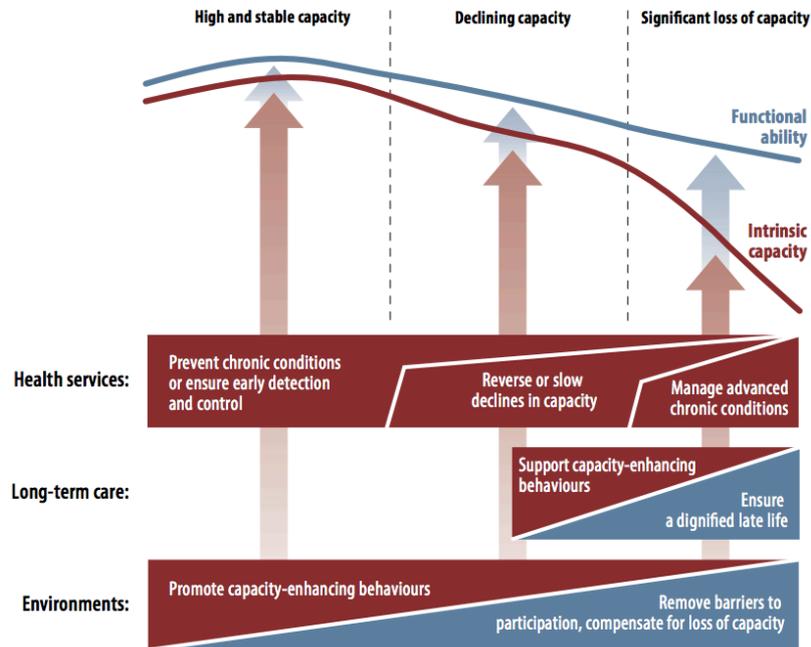


Figure 3. Environment and Ageing (World Health Organization., 2015)

Having a high quality of life both on a subjective and objective level is referred as a successful ageing (Pruchno et al., 2010). The current review explores the areas affected through ageing, and difficulties hindering a healthy ageing process. Furthermore, it will assess in what ways physical activity enhances healthy ageing.

The following chapters will describe, the previous described dimensions, which are highly correlated to each other (Radak et al., 2019; Spirduso et al., 2005). This review will look at it from separate perspectives focusing on the effect of physical activity on each dimension. The American college of Sports Medicine suggests that all older adults should engage in regular physical activity and avoid an inactive lifestyle (Chodzko-Zajko et al., 2009; Diaz et al., 2017)

3 Physical dimension

This chapter will look into physiological changes related to ageing, which is decline of physical function (Bouchard et al., 2012). Decline in physical function and impairments are strongly related to weight loss, loss of height, vision problems, osteoporosis and sarcopenia (Marty, Liu, Samuel, Or, & Lane, 2017; Spirduso et al., 2005). One of the more immediate and obvious age-related physical impairment is weight loss (Albanese et al., 2013). With the age-related degenerative neurological development brings -cognitive impairment that may cause weight loss (Albanese et al., 2013; Niccoli & Partridge, 2012). Due to changes in diet, energy imbalance and an advanced stage of diseases, the body is unable to maintain its regular energy intake (Toth & Poehlman, 2000). For the weight-loss phenomenon, it is interesting to mention the loss of thirst, and modifications in water metabolism in older adults (Adeleye, Faulkner, Adeola, & ShuTangyie, 2002; Ferry, 2005). Losing the sense of thirst results in dehydration which can be well related to weight loss as well as causing vast physiological problems (Ferry, 2005; Spirduso et al., 2005).

3.1 Physical impairment and Physical Activity

Sarcopenia is defined as having age-related decline of skeletal muscle, which is related to weight loss among older adults (Confortin, Ono, Barbosa, & d'Orsi, 2018; Kwak, Kwak, Yoon, Kong, & Chang, 2019). Risk factors for sarcopenia include poor nutrition, decrease in hormones as well as myoneural junctions, and elevated inflammation (Walston, 2012; Wilson, Jackson, Sapey, & Lord, 2017). One way to prevent sarcopenia is being physically active (Chauveau, Moreau, Lasseur, Combe, & Aparicio, 2017). Research suggests that targeted exercise intervention, alongside adequate nutrition, seems to be the most efficient therapy to combat sarcopenia (Stoeber, Heber, Eichberg, & Brixius, 2017; Walston, 2012).

The visual system is a primary contributor to movement, providing information about the environment including location, direction and speed of the individual movement (Sturnieks, St George, & Lord, 2008). Visual ageing is also part of physical decline. that most older adults experience a degraded vision which provides decreased or distorted information (Fiorentini, Porciatti, Morrone, & Burr, 1996). It suggests older adults with age related decline in vision

have difficulties to detect spatial information that would assist in movement control. (Spiriduso et al., 2005)

Loss of height is yet another physical decline inhibited by ageing (Muthuri et al., 2019). It is common in older adults especially among women, most likely due to hormonal changes (Ginaldi, Di Benedetto, & De Martinis, 2005). Osteoporosis is a disease identified by low bone mass and poor structural quality of the bone (Gerdhem, Ringsberg, Akesson, & Obrant, 2003; Spiriduso et al., 2005). The hormonal change among women is one of the main factor explaining why women are more likely to develop osteoporosis (Ginaldi et al., 2005). Physical activity, especially resistance training, helps to keep healthy and strong bones, and thereby reduce or prevent osteoporosis (Nguyen, Sambrook, & Eisman, 1998). On a functional level, regular physical activity also prevents and treats diseases such as diabetes, heart disease, stroke, and breast and colon cancer. (World Health Organization., 2018). Evidence suggests that physical activity, throughout a lifetime has accumulative benefits on bone health in later life (elderhood) (Muthuri et al., 2019). However, lifelong physical activity must be maintained (Kannus, 1999). In conclusion, there is enough evidence suggesting that physical activity has a positive impact among older adults both to prevent further decline as well as to improve physical function (Caspersen, Kriska, & Dearwater, 1994; Radak et al., 2019; Yanowitz & LaMonte, 2002).

4 Cognitive dimension

Cognitive ageing refers to processes of mental or intellectual functioning, which induces transformation of information (Bishop et al., 2010; Petersen et al., 1997; Salthouse, 1985). Previous research reported that hypertension, coronary disease, cerebrovascular disease, and atherosclerosis are related to the impairment in neuropsychological function (Cabeza, Anderson, Locantore, & McIntosh, 2002; Chudiak, Uchmanowicz, & Mazur, 2018; Liang et al., 2018). Evidence suggests that physical activity reduces the likelihood of cognitive impairment in later life (M. Chang et al., 2010; Y. K. Chang et al., 2017). At the same time being physically active improves cognitive function in multiple domains, such as global cognition, attention, executive function, verbal fluency, and memory (Fabre, Chamari, Mucci, Massé-Biron, & Préfaut, 2002; Poinssatte et al., 2019).

When the human brain adapts to its environmental demands, it is a phenomenon referred to as neuroplasticity (Douyon, 2019). This adaptation takes place through changes in its functional and structural composition (Kempermann, Gast, & Gage, 2002). (Hötting & Röder, 2013). Neuroplasticity happens through physical activity improving enhancement of neural mechanisms such as neurogenesis, synaptogenesis, angiogenesis and the release of neurotrophic (Bertoni-Freddari et al., 1992; Hotting & Roder, 2013; Minirth, 2007). Nevertheless, it is interesting to point out that, as research suggests, in order to maintain neuro-cognitive benefits inhibited through physical activity, an increase in cardiovascular fitness levels must be maintained (Hötting & Röder, 2013).

4.1 Dementia

Brain disorders including dementia and mild cognitive impairment are the main factors contributing to loss of independence (van der Wardt et al., 2019). Approximately 50 million people are diagnosed with dementia worldwide (Fratiglioni, De Ronchi, & Agüero-Torres, 1999; Wortmann, 2012). The prevalence continues to increase and it is estimated to reach 132 million by the year 2050 (Prince et al., 2016). Dementia causes overall deterioration, Alzheimer's disease being the most common form of dementia, contributing 60-70% of cases (World Health Organization., 2019). Dementia has a physical, psychological, social and economic impact (Allegri et al., 2007; Wimo et al., 2017; Wimo et al., 2013; Wittenberg et al.,

2019). Currently, dementia has become one of the main causes of disability and dependency among ageing population in the world (World Health Organization., 2019; Zarit, Reever, & Bach-Peterson, 1980). Dementia also provokes reduced autonomy, eating trouble, and poor appetite (Albanese et al., 2013). These factors contribute to the weight loss, which was discussed in the physical dimension chapter (Albanese et al., 2013; Niccoli & Partridge, 2012). These factors are of concern for those with dementia (Albanese et al., 2013). The impact of dementia does not only affect the individuals with dementia, but also their care-takers (relatives or nurses) and society as a whole (Bergman et al., 2016; McCarthy, 2013).

4.2 Cognitive impairment and Physical Activity

Previous studies suggested that there is a positive association between physical activity and cognition (Brett et al., 2019; Geda et al., 2010; Voss et al., 2016). Physically active older adults are generally healthier, have better physical function, and perform better on cognitive tests (Fabre et al., 2002). Besides having higher levels of physical fitness and cognitive scores, active older adults also have less symptoms of anxiety and depression compared with inactive older adults (Spirduso et al., 2005; Tarazona-Santabalbina et al., 2016). Furthermore, research suggests that aerobic fitness reduces brain tissue loss in ageing individuals, and therefore contribute to brain health (Colcombe et al., 2003). As well as cardiovascular fitness enhancing cortical plasticity throughout ageing (Colcombe et al., 2004; Kramer, Colcombe, McAuley, Scalf, & Erickson, 2005).

Another benefit of physical activity is the effect on the brain that it is associated with generating new neurons among older adults through enhancing blood circulation to the brain (Cotman, Berchtold, & Christie, 2007). This increase of blood supply in the brain helps the organism meet its environmental demands by having tissue-adaptation (Churchill et al., 2002).

An observational study (Masley, Roetzheim, & Gualtieri, 2009) reported that only 10 weeks of increasing frequency of aerobic activity shows reinforcement in cognitive performance. Further research, conducted on the effects of multimodal training on older adults, reaffirmed that 6 months of intervention have a significant benefit as well (Gudlaugsson et al., 2012). Besides a 5-7% increase in overall physical performance, this 6 months of training improved strength, balance and physical activity increased by 32-39% (Gudlaugsson et al., 2013). This and further observational studies found that physically fit individuals had better execute cognitive function (Masley et al., 2009), and they were less

likely to experience cognitive decline in later years (Zhu, Bao, & Swaab, 2019). Furthermore, physical activity seems to protect the brain's structure and its function (Podewils & Guallar, 2006). Therefore, it is important to start an active lifestyle as early as possible (Jeste et al., 2010; Masley et al., 2009; Zhu et al., 2019). Previous studies show that, despite being in good health in older age, it still seems important to stay physically active (Buchman et al., 2012; Podewils & Guallar, 2006). In comparison to physically active older individuals, healthy older individuals with low levels of daily physical activity are twice more likely to develop Alzheimer Disease (Buchman et al., 2012; Podewils & Guallar, 2006). Evidence shows that physical activity accompanied with music causes neuroanatomical changes in the brain and generates positive effects on cognition in older adults (Tabei et al., 2017; Zhu et al., 2019). Therefore, combining physical activity and music can be a useful way of intervention to decelerate cognitive decline among older adults (Tabei et al., 2017). However, this might not apply to everyone, since there is also evidence which suggests that music can impair visual associative memory performance in older adults (Reaves, Graham, Grahn, Rabannifard, & Duarte, 2016).

4.3 Psychological dimension

The interactional quality of these dimensions, is though nothing new. Already in ancient Rome, the poet Juvenal wrote "*mens sana in corpore sano*", meaning healthy mind in a healthy body (Podewils & Guallar, 2006). However, we will regard the psychological aspect of ageing, as a part of the cognitive dimension. Anxiety and depression are very common indicators for psychological health among ageing populations (Taylor, 2014). Physical illnesses and disability have negative consequences that they induce dependency, social isolation, loneliness, and financial difficulties. With the process of ageing come inevitable losses of close ones, and therefore, sorrow, and possibly depression (Spirduso et al., 2005). Depression has a negative impact on successful ageing. Depressive symptoms among older adults, are related to little physical activity or productivity, poor nutrition, increased social isolation, and negative future prospects (Jeste et al., 2010).

Psychological Well-being

Psychological well-being and positive psychological symptoms are highly related to mortality, meaning happy people live longer (Chei, Lee, Ma, & Malhotra, 2018; Frey, 2011). Longer life-spans seem to be strongly influenced by higher sense of purpose in life, optimism, and overall positive attitude toward ageing (Jeste et al., 2010; Lazarus, 1993). Self-esteem is built on self-awareness of physical competence, body consciousness, and self-efficacy with regard to physical function or skill (Lazarus & DeLongis, 1983). Physical conditions or limitations which come with age, can be a disturbing factor for self-esteem (Spiriduso et al., 2005).

Psychological dimension and Physical Activity

There is a large number of evidence to support the fact that physical activity enhances mental health and psychological well-being (Camacho, Roberts, Lazarus, Kaplan, & Cohen, 1991; Paluska & Schwenk, 2000). Participating in physical activity requires attention, total involvement and commitment. Strong connection between emotions and physical activity is an important tool for quality of life (Spiriduso et al., 2005).

Outdoor physical activity is considered to have many positive effects. The literature also differentiates between neural response to physical activity performed in urban green spaces, versus in urban busy or quiet spaces (Hillsdon, Panter, Foster, & Jones, 2006; Richardson, Pearce, Mitchell, & Kingham, 2013). The green spaces seem to have a restorative effect on older adults. This effect is linked to a high level of engagement in these spaces, in contrast to when the environment was busy (Neale et al., 2017). Furthermore, group physical activity showed a positive impact on mood improvement even in a very low intensity physical activity (Kritz-Silverstein et al., 2001; Netz, Wu, Becker, & Tenenbaum, 2005; Spiriduso et al., 2005).

Longitudinal research of 25 years reported that individuals who performed regular physical activity during midlife were less likely to develop depressive symptoms later in life (M. Chang et al., 2016). It suggests that promoting physical activity for middle-aged population is also beneficial which would help them to engage an active lifestyle early to improve psychological well-being throughout the ageing process (M. Chang et al., 2016; Zhu et al., 2019). There is a vast amount of research supporting the fact that people who report more

physical activity report less depressive symptoms (Bridle, Spanjers, Patel, Atherton, & Lamb, 2012; M. Chang et al., 2016; Hrafnkelsdottir et al., 2018; Zhu et al., 2019).

Women seem to be more prone to depressive symptoms, and anxiety, than males (Teixeira, Vasconcelos-Raposo, Fernandes, & Brustad, 2013). Furthermore, suicidal rates are high among older population. The causes of suicide in ageing population are mostly because of depression and chronic diseases (Conwell & Thompson, 2008; Quan, Arboleda-Flórez, Fick, Stuart, & Love, 2002; Spirduso et al., 2005; Waern, Rubenowitz, & Wilhelmson, 2003). Despite growing evidence on the positive effects of physical activity on depressive symptoms and anxiety, physical activity is still a rare prescription in clinical environments (Ströhle, 2009).

The retirement as a life-changing event among older adults also brings loss of purpose and increase in depressive symptoms. Research shows that physical activity is associated with lower post-retirement depression (Parker & Parker, 2005).

In conclusion, physical activity enhances long-term quality of life in older adults, enhancing efficacy and esteem (Elavsky et al., 2005; Jeste et al., 2010; Spirduso et al., 2005).

5 Healthy Ageing with Physical Activity (Successful Ageing)

Successful ageing is a multi-dimensional process (Jeste et al., 2010; Pruchno et al., 2010). Older adults with high life satisfaction, tend to have a clear sense of well-being (subjectively) as well as better health (objectively) (Chei et al., 2018; Elavsky et al., 2005; Spirduso et al., 2005). Research supports that physical activity enhances physiological processes which are protective to depressive disorders (Hamer, Lavoie, & Bacon, 2014; Kritz-Silverstein et al., 2001). The processes include a more cohesive cardiovascular system; increase of monoamine neurotransmitters, which amongst others are important for memory (Ströhle, 2009); endorphins, which are released and improve the mood state (Morgan, 1985). Finally, it also includes the thermogenic hypothesis (Hoppeler, Baum, Lurman, & Mueller, 2011). This hypothesis assumes that physical activity-induced elevation in body temperature may produce, through muscle relaxation, psychological changes, such as reduced anxiety. However, currently, one in four adults, and three in four adolescents, are not fulfilling the worldwide recommendations for physical activity by the World Health Organization (Blair & Haskell, 2006; Diaz et al., 2017; World Health Organization., 2018). Physical activity should be a natural part of everyone's daily habit and environment. Having an active lifestyle throughout all age groups is essential to maintain a healthy functioning body (World Health Organization., 2018).

5.1 Healthy life expectancy

Healthy Ageing reflects the ongoing interaction between individuals and the environments which results in trajectories of both intrinsic capacity and functional ability (World Health Organization., 2015). Among healthy older adults who have been physically active through life course, the baseline levels of circulating adaptive immune cells, are altered (Nieman & Pedersen, 1999). There's evidence suggesting that long-life, moderate physical activity, increases resistance to upper respiratory tract infections (Nieman, 1998). On the other hand, if physical activity or prolonged training is overly straining on the system, an excess of anti-inflammatory regulatory immune cells can provoke immunosuppression and therefore increased risk of infection (Pedersen & Toft, 2000). Furthermore, longitudinal

studies have shown that the present is what matters. Meaning, that improvement by picking up a physically active life-style, is still possible and important (Hamer et al., 2014).

There are a number of barriers which interfere with older adults being physically active. Including lack of energy, fear of injury, lack of time, lack of optimal space to be physically active, caregiving duties, or concern about appearance (Spirduso et al., 2005). Nevertheless, there still remains uncertainty in this field of research. Physical activity might just be one of the possible factors, contributing to healthy ageing (Pascual-Leone, 2001). It has been reported that physically active people, are often socially and cognitively more engaged (Tarazona-Santabalbina et al., 2016). These two factors, also have a positive effect on cognitive function (Podewils & Guallar, 2006). Furthermore, research suggests that combining Physical Activity and Cognitive stimulation training could be the best intervention for further decline of cognitive function (Hötting & Röder, 2013; Jak, 2012). This is also possible through environmental conditions such as bilingualism or multilingualism, education, occupation, playing instruments, physical activity and leisure activities (Pascual-Leone, 2001; Zhu et al., 2019). The active ageing report also promote activities to create better opportunities for older adults to prevent cognitive decline (World Health Organization., 2015, 2018).

6 Discussion & Conclusion

It is clear that the ageing population is growing, and that it will comprise a large part of the world population (World Health Organization., 2015). Our community faces ageing-related changes and challenges which would affect both the individuals and society as a whole (Russo & Vitaliano, 1995; Zarit et al., 1980). We need to alleviate and build up solutions for better well-being and quality of life for everyone as far as possible (Bouchard et al., 2012; Gudlaugsson, 2018).

Ageing affects cognitive, physical and psychological dimensions, which are all correlated, often in a negative way (Jeste et al., 2010; Pruchno et al., 2010). The solutions offered by public health or health service have not proven to be efficient (Bouchard et al., 2012). Nevertheless, there is a large amount of evidence suggesting the positive effects of physical activity in both preventing and delaying age-related changes in the physical and cognitive function (M. Chang et al., 2010; Colcombe et al., 2003; Cotman et al., 2007). It would be worth considering its implementation in the society (Spiriduso et al., 2005; World Health Organization., 2018). Introducing physical activity into daily routines and establishing it as a lifestyle has proven to be highly effective in preventing and maintaining health throughout later years (Gmiat et al., 2018; Niccoli & Partridge, 2012; World Health Organization., 2018).

In conclusion, the creation and promotion of environments which promote and reinforce physical activity as a part of daily life, for everyone in our society, is a crucial factor for an ageing population (Arnardottir et al., 2016; Chrysikou et al., 2016; World Health Organization., 2018). Physical activity which is accessible and enjoyable for everyone, included older adults (Hotting & Roder, 2013; Jak, 2012; Neale et al., 2017; Spiriduso et al., 2005; Zhu et al., 2019). Promoting physical activity as well as improving the environments to adapt physical activity will enhance a healthy lifestyle that will allow people to stay active in physical, cognitive, and social aspect.

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