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EFFECTS OF 12-WEEK GYM EXERCISE TRAINING ON FUNCTIONAL CAPACITY AMONG ELDERLY ADULTS

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The population of the world is aging along with the increase in life expectancy among the elderly. Approximately one-third of persons aged 65 or older are physically inactive, which leads to various medical conditions and increased health care costs, incurred to treat these medical conditions. However health care expenses may be reduced by regular physical activity.

This thesis was a part of the fitness training project for seniors in the municipality of Nakkila in Western Finland, the aim of which was to maintain and/or improve the well-being and physical functioning of elderly individuals by means of exercises, in order to prolong their capability of living at home. The purpose of this study was to find out how 12-week gym exercise training held in Nakkila fitness center affected walking speed and hand grip strength of elderly adults.

In this study a descriptive non-experimental research method with qualitative and quantitative data collection was used. The study covered seven elderly adults participating in a one-hour instructor-led gym exercise session two times per week for 12-week period. Pre- and post-programme data were obtained through structured and semi-structured interviews and functional measurements: Isometric Hand Grip test and Ten-Meter-Walk test. Structured interviews and functional measurements were evaluated by descriptive analysis and inferential statistical analysis using Tixel statistical software package. Significant difference was determined using paired two tailed t-test. Statistical significance was accepted for all tests at a value of $p < 0,05$. Semi-structure interviews were examined by deductive content analysis.

The study results indicated that after the 12-week intervention, there were no statistically significant changes in hand grip strength and walking speed of the study participants. However the examinees reported improvements in balance, mobility, pain level, muscle strength, functional performance on daily activities and overall physical condition.

In conclusion, the 12-week training programme used in this study was not effective for producing significant benefits to the study participants' hand grip strength and walking speed. Exercise intervention utilized in this study was not considered to be feasible in community-dwelling elderly examinees due to insignificant results. Hence further studies with a larger sample size are required.

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1 INTRODUCTION

The population of the world is aging. According to the latest United Nations population estimates, the current population aged of over-60, which has surpassed 700 million in 2009, is expected to triple its size by 2025 (United Nations 2009, 4-23). Along with the graying of the population, life expectancy among the elderly has been increasing for many decades. It rose rapidly in the first half of the 20th century and has increased steadily (by a quarter of a year every year) since then, bringing global life expectancy to its current level of 66 years. (Barkan 2011; Lubitz, Liming, Kramarow & Lentzner 2003, 1048-1055)

It has been determined that that nearly half of hospitalized adults are 65 years of age or older (Kleinpell, Fletcher & Jennings 2008, 1). The demand for health services and hospital care is expected to increase rapidly as the population ages, since elderly people "are at high risk for costly, age-associated chronic diseases and other health conditions". With the increase in the number of older adults living longer, the health care system is likely to be devastated unless preventative measures are taken. (Nagamine, Jiang & Merrill 2006, 1-2)

It is estimated that nearly one-third of persons aged 65 or older follow a sedentary lifestyle. Physically inactive individuals are at "risk for many chronic diseases and conditions including cardiovascular disease, stroke, colon and breast cancers, type II diabetes, obesity and osteoporosis" (United States Department of Health and Human Services 2002, 1-3). The increased number of medical conditions leads to larger health care costs, incurred to treat these medical conditions and manage their symptoms, and costs associated with disability and premature mortality (Medibank Private 2008, 3-5). "These costs may include expenditures for physician visits, pharmaceuticals, ambulance services, rehabilitation services and hospital, and nursing home care" (United States Department of Health and Human Services 2002, 3-7). Furthermore there are 'quality of life' costs related to physical inactivity. These social costs are associated with the ill individual and their family in terms of the "reduction of quality of life due to such concerns as disability, anxiety, pain, and suffering" (Medibank Private 2008, 7-11).

However, health care costs may be reduced by regular physical activity. Researchers from the Centers for Disease Control and Prevention concluded that "physically active people had, on average, lower annual direct medical costs, fewer hospital stays and physician visits and used less medication than physically inactive people". Research has demonstrated that regular physical activity can be beneficial for nearly all individuals. Even weak and very old adults can improve their functioning and mobility, which are often declined due to the aging process. (United States Department of Health and Human Services 2002, 8-10)

Finland is the most expeditiously ageing country in Europe. The number of Finnish people over 75 years old is expected to double by 2040. "The ageing of the population means both an increase in the need for services and a decrease in the workforce because of retirement". Ageing of the population has induced the Finnish society to consider future visions of the consequences of this (Pekkarinen 2001, 24-27). Finnish elderly care system is advancing nowadays. There are 452 municipalities in the country, each of which has a Senior Citizen Council, responsible to advance the well-being of senior citizens and support activities and projects for their welfare considering their rights to dignity and independence (Watanabe 2001).

This thesis is a part of the fitness training project for seniors in the municipality of Nakkila in Western Finland conducted in co-operation with the Nakkila Fitness Center. The aim of the project is to maintain and/or improve the well-being and physical functioning of elderly individuals by means of exercises, in order to prolong their capability of living at home. (Lempäälän kunta 2011)

In the present study, this issue was addressed by undertaking 12-week controlled exercise training trial with seven elderly subjects living at home environment. The aim was to determine whether varied gym exercise training has beneficial effects on the elderly participants' walking speed and hand grip strength.

2 FUNCTIONAL CAPACITY OF THE ELDERLY

Aging is a natural process affecting all biological systems, nevertheless in the human community its perception is socially constructed (Venne 2003, 1). According to the World Health Organization (WHO) in the most developed world countries the chronological criteria that is presently used for identifying "elderly" is strictly arbitrary and usually has been set at 65 years. Yet the onset of some of the health problems of elders may occur as soon as they enter their early 50s. Hence "chronological time has little or no importance in the meaning of old age". "Socially constructed definitions of age are more significant such as roles assigned to older people" (work patterns, adult status of children and menopause), and the loss of roles accompanying physical decline (invalid status, senility and change in physical characteristics). (World Health Organisation 2007) Therefore "aged", as commonly used, can be defined as a state or condition that may or may not be associated with chronological age and more often reflects the loss of an individual's ability to maintain independence (Guccione 2003, 29).

Since the turn of the century the number of individuals over the age of 65 years has increased, with the most remarkable rise occurring in the number of people 85 years of age or older. With the increase in the number of elderly persons, there has been a corresponding rise in the number of individuals with the disability. According to data from the 1987 National Medical Expenditure Survey, an estimated 9.5 million community-dwelling elders experienced difficulty performing basic life activities such as self-care, walking, and housekeeping. Approximately 55% of them were over the age of 65 years. The probability of having difficulties with basic living activities increases with age. From 65 to 74 years of age, one in nine (11,8%) has difficulty in performing basic activities. This ratio increases to one in four adults (26,5%) for those aged 75 to 84 years and to three in five adults (57,6%) of those aged 85 years and over. (Disability Statistics Program 1992)

Functional capacity is important in sustaining independent life and overall well-being for the older adults. It is a broad concept that may comprise psychological, social and physical functioning as well as performance of activities of daily living (Carvalho &

Assini 2008, 269). Psychological function has two components-mental and affective. Mental function covers a range of cognitive elements, such as attention, memory, concentration, and judgment that are essential to living independently as an adult. Affective function broadly refers to such elements as anxiety, depression, self-esteem, and coping, that are part of every elder's experience. Social function encompasses an individual's social activities as well as performance of social roles and obligations, all of which demand a certain degree of physical ability. (Guccione 2003, 53, 115, 126-127; Grundy & Glaser 2000, 149-157; Kane 2002)

Physical function covers an individual's sensorimotor performance in the implementation of particular activities, such as walking, climbing, bending, lifting, carrying, rolling and getting out of bed. These sensorimotor functional abilities underlie the fundamental daily organized patterns of behaviors that are further classified as basic activities of daily living (ADL) such as toileting, grooming, bathing, dressing and feeding. The more complex tasks associated with independent community living are categorised as instrumental activities of daily living (IADL) such as cooking, shopping, housekeeping or using public transportation. Successful performance of complex physical functional activities requires integration of cognitive, affective and physical abilities. Yet decreased functional capacity contributes to the risk of falls and a decline in the physiological organ systems, which in turn lead to a more dependent lifestyle and earlier institutionalization-a costly health problem. (Guccione 2003, 53, 115, 126-127; Grundy & Glaser 2000, 149-157; Kane 2002)

There is a minimum set of criteria of physical functioning required to perform activities of daily living. It is defined as the functional performance threshold and includes such measures as strength, range of motion, endurance, and balance. Young adults have significant physiological capacity and reserve that allow them to perform activities and exercise well in excess of the metabolic and physical demands required by routine daily activities of living. They function well above the functional performance threshold and possess a large reserve. With aging, however, changes to the various organ systems, particularly the heart and skeletal muscles, reduce the physiological capacity and reserve (See Figure 1). Thus the older adult performs daily routines closer to the functional performance threshold. The physiological

reserve of the older adult is limited. If a decline in health status results in a functional capacity below this critical threshold of functioning, the older adult will be unable to do self-care activities and live independently. Falling below this critical threshold can result from progressive age-related changes or an extended period of immobility or illness sufficient to lower an older adult's already minimal reserves. Therefore the loss of physiological reserve increases the risk of disability (Cassel, et al. ... 2003, 1025; Guccione 2003, 32).

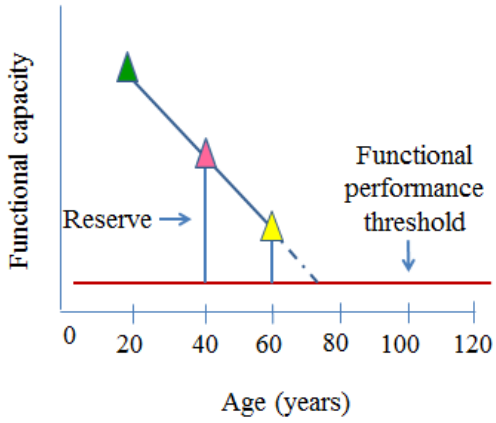

Figure 1. Functional capacity declines with age (Modified from Cassel, et al. ... 2003, 1025).

An individual's ability to perform functional activities mainly depends on the integrity of the cardiovascular system and its ability to influence oxygen transport and tissue oxygenation. Both the physiological and the structural changes that occur in the cardiovascular system with aging influence the reserve capacity and bring the older adult closer to the functional performance threshold. Specifically, the age-related changes in the cardiovascular system decrease cardiac functional reserve capacity, limit the performance of physical activity, and lessen the ability to tolerate a variety of stresses, including cardiovascular disease. Yet, despite these changes, the cardiovascular system continues to function reasonably well in supplying the needs of tissues, at least at rest. In the presence of stress, during exercise or in response to situations imposing an increase in metabolic demand for oxygen, age-related alterations are obvious and limit functioning. (Guccione 2003, 32)

A persons' ability to perform functional activities, such as walking, stair climbing, and carrying packages, is also dependent on the integrity of the skeletal muscle

system. Activities of daily living require minimum amount of muscle strength and muscle endurance. The required muscle strength and endurance can be referred to as a functional performance threshold. However with age these simple activities of daily living may become difficult because of a reduction in muscle mass and muscular strength. Weakness in lower extremities has been implicated with difficulties in rising from a chair and getting out of bed, in slow gait speed, and in balance problems and falls. (Guccione 2003, 32)

Hence the lack of functional capacity or falling below the functional performance threshold of muscle strength and endurance can lead to a more dependent life-style and earlier entry into long-term care facilities. The decrease in functional capacity of muscle strength and endurance also contributes to the risk of falls, a decline in bone density, and the incidence of hip fractures and orthopedic injury in older adults. In the cardiovascular system, the change in functional capacity or reserve is not noticed until the individual is stresses due to exercise or an illness. (Guccione 2003, 32-33)

3 EXERCISE EFFECT ON FUNCTIONAL CAPACITY OF THE ELDERLY

The term “exercise” can include “movement”, “activity, “play”, or sport by individuals or groups of people. Exercise involves a time commitment to motor activity that is hopefully enjoyable and is usually applied beyond the level to the routines of daily life. Exercise is therefore possible for able and disabled individuals (National Health and Medical Research Council 1994, 1). Regular exercises in later years help to avoid the typical age-related decline in functional capacity, which often happens due to inactivity rather than a natural effect of ageing (See Figure 1) (National Heart Foundation of Australia 2005). Goals of exercise appropriate to younger adults, such as prevention of diabetes, cardiovascular disease, cancer, and raise in life expectancy, are substituted in the elderly population with new goals. This set comprises minimizing biological changes of aging, increasing mobility, withdrawing disuse syndromes, the control of chronic diseases, maximizing

psychological health and function, and assisting with rehabilitation from acute and chronic illnesses for many of the geriatric syndromes common to the elderly (Burbank & Riebe 2002, 221).

Cardiac and skeletal muscle adaptation occurs because of changes in intensity, duration, and increase or decrease of physical activity's frequency. These adaptions lead to altered functional characteristics from the cellular to the whole tissue and functional performance levels. In exercise training adaptations take place in the metabolic and physiological systems, depending on the type of overload imposed. The strength training or resistance exercise ('training in which the resistance against which a muscle generates force is progressively increased over time") induces specific strength adaptations, and results in enhanced capacity to develop maximal power after exercising. While aerobic exercise (training that takes place in the presence of oxygen and involves aerobic metabolism of glucose) stimulates endurance-training adaptations. Strength and endurance training adaptations can happen either independently or simultaneously in case appropriate training programs are used. (Guccione 2003, 49)

During aging, there is a gradual decrease in muscle mass, as a result of disease, disuse, malnutrition, and the natural effects of aging. Muscle weakness that accompanies advanced age has been related to the risk of falling and fracture in the elderly adults (Guccione 2003, 49). Current evidence clearly indicates that the body maintains its ability to adjust to physical activity throughout life, even in those with previously inactive lifestyle (National Heart Foundation of Australia 2005). It means that even older individuals, well into their tenth decade of life, retain the capacity to adapt to resistance or strength training with significant and clinically relevant muscle hypertrophy (increase in muscle size) and growth in muscle strength (Hirofumi 2009, 57-65).

The increased strength and muscle hypertrophy in addition to the changes in the body composition, and adaptation of hormonal and nervous systems associated with resistance training, have a substantial impact on the daily activities of living and functional independence of the aging adults (Hirofumi 2009, 57-65). According to the study conducted for frail elderly aged 89-91 years living in a nursing home, a high-intensity 8-week progressive resistance training (exercises in which intensity is

increased periodically) improved strength on the average of 174%, with a mean increase in muscle cross-sectional area of 15%. These growths in muscle size and strength were associated with clinically significant improvements in balance, gait speed and functional independence. (Fiatarone et al. ... 1990, 3029-3034)

Resistance training can also have significant benefits for protection aging adults from injuries, since falling is strongly related to weakness in hip muscles, poor balance and postural control. A study by Suetta et al. on the individuals aged 60-86 reveals that an exercise training in the form of therapeutic rehabilitation that is started after hospitalization due to acute illness, disease, or surgery, has the potential to prevent disability and institutionalization in the elderly by improving muscle function. (Guccione 2003, 49; Suetta et al. ... 2004, 2016-22)

Muscle hypertrophy throughout resistance training program can be affected by total food intake and selected nutrients. As demonstrated by the study of Evans conducted for the individuals aged 70 years and over, progressive strength training has intense metabolic (build up) effects in older people, meaning that it helps to increase energy requirements, to decrease body fat percentage, to maintain metabolically active tissue mass, and to improve insulin action. In addition to these positive effects on the body, strength training may also be an important adjunct to increase overall levels of physical activity in the elderly. (Evans 2004, 601-603)

Earlier investigations showed that with age the rate of decline in maximal oxygen uptake (the capacity of the cardiovascular system to deliver oxygen to the working skeletal muscles and the ability of the muscles to extract oxygen from the blood to generate energy in the form of adenosine triphosphate) is significantly smaller (only 50% as large) in adults who perform regular aerobic exercise (Guccione 2003, 43; Hirofumi 2009, 57-65). The blood flow to the muscles increases with aerobic exercise. To do the work muscles need oxygen, and the increased muscle activity associated with aerobic exercise makes body to allow for more oxygen to the muscle being used. This is possible due to peripheral adaptation or an increase in skeletal muscle capillary densities, and mitochondrial enzyme levels and activity. As a result the heart and the lungs work better and harder, improving and strengthening the work of cardiovascular and respiratory systems. (Guccione 2003, 50)

Although both aerobic and strength training are recommended to improve muscular function in the elderly individuals, only resistance training can reverse or delay the decline in muscle mass and strength with aging. Increased mass and strength are key components in maintaining independence in functional activities of daily living in elderly for who atrophy (disuse) has limited fundamental daily activities. Aerobic exercise has long been recommended for individuals with many age-associated chronic diseases, such as hypertension, heart disease, osteoporosis and non-insulin-dependent diabetes mellitus. Including both aerobic and resistant training into the life-style of the elderly can have a significant impact on the functional capacity, physiological reserve and independence. Training improves the functional capacity and quality of life, bringing the older individual well above the threshold of performance. (Guccione 2003, 51; Mazzeo et al. ... 1998)

Inactivity or immobilization (a decrease in physical activity) is the opposite spectrum of exercise training. A sedentary life-style for elderly persons is not uncommon. It has been estimated that only 45% to 66% of older individuals participate in regular exercise, even though activity seems to be critical to maintain mental and physical health (Guccione 2003, 294). With inactivity, there is a considerable weakening in muscle strength and endurance, and rapid decline in the mass of the skeletal muscles. In the cardiovascular system, maximal oxygen uptake decreases while blood pressure, resting and submaximal heart rates increase. Total volumes of blood and plasma are reduced, whereas blood viscosity is increased along with the risk of thromboembolism (the development of a clot within blood vessels) (Smeltzer, Bare, Hinkle & Cheever 2008, 967). The rate of deconditioning during immobilization has been reported to exceed that of exercise training, which has particular consequences in the older individual with less physiological reserve. The effects of immobilization are accentuated in the faster growing segment of elderly population. (Guccione 2003, 51)

While the physical benefits of exercise are quite obvious, the psychological benefits are not as commonly known. Although depression is a regular finding in the elderly, mood status seems to change with disability and inactivity. The study conducted by Barbisoni on the influence of physical activity on depression of the elderly women with age range from 60 to 93 years with good cognitive status, revealed that

depressive symptoms had substantially improved after a course of physical exercise programme, and that smaller symptoms were seen in patients with less initial symptomatology (Barbisoni 1996, 346-349). Research has shown that exercise has positive effect on psychological well-being. After physical activity programs elderly adults report having more social interactions, increased community involvement, remarkable raise in self-esteem and a more positive attitude towards life. (Guccione 2003, 295-296)

4 ASSESSMENT OF PHYSICAL FUNCTION

Physical function is an important domain of functional capacity from the perspective of quality of life and independence of an elderly individual. Although all three dimension of functional capacity (psychological, social and physical) are included in the measurement of a person's overall health status, physiotherapists are most often concerned with evaluating and diagnosing physical functional limitations. Assessment of longitudinal changes in physical function in elderly people is useful for identifying critical risk factors, where early intervention, effective treatment and rehabilitation can help to improve the quality of life of an elderly individual and in the best case give him or her more active years. (Guralnik et al. ... 1994, 85-94)

One way to examine functional capacity in the older individuals is to assess their level of ability in carrying out activities of daily live. To be able to manage those activities satisfactorily a person requires at least a basic level of physical functioning. Therefore, in recent years functions of an individual were measured by using simple physical tests, such as measurements of walking speed and muscle strength. (Laukkanen, Heikkinen & Kauppinen, 1995)

4.1 Hand Grip Strength

Hand strength is crucial for many aspects of daily life. Hand function may be used to identify elderly persons with disability, functional limitations and estimate the risk of disability in non-disabled individuals. Decrease of muscle strength, usually associated with aging, may be one of the links between reduced physical performance and functional decline. (Giampaoli et al. ... 1999, 283-288)

Studies demonstrate that muscle strength declines as age advances in both males and females. Hand grip strength is an indicator of isometric strength in the upper extremity, but is also linked to strength in other muscle groups, and hence has been taken as an indicator of overall muscle strength. Grip strength has proven to be a strong predictor of physical functioning, disability, morbidity and mortality. Reduced hand grip strength lowers a person's ability to accomplish activities of daily living such as grasping, holding, lifting and carrying various objects. The recommended hand grip strength, required to manage daily activities, should be at least 20 per cent of body weight. (Rantanen, Pertti, Kauppinen & Heikkinen 1994, 206-220; Valtiokonttori 2005)

Hand grip strength was found to increase up until the 30s and start to decline with accelerated speed after 40s. Analysis of grip strength by gender shows higher grip by males at all ages. Healthy men and women in their 70s and 80s usually have 20% to 40% less strength than young individuals. Cross-sectionally, decreased muscle strength is connected to lower muscle mass. With aging, muscle mass is lost due the following factors: death of motoneuron, shrinking of muscle cell due to inactivity, hormonal changes and diseases. (Kallman, Plato, & Tobin 1990, 82-88; Metter, Conwit, Tobin & Fozard 1997, 267-276) The loss of strength may have a marked effect on the capacity of elderly people to lead independent lives. Hence testing hand grip strength will help to monitor its decline and can give an indication of risk. (Runnels, Bemben, Anderson & Bemben 2005, 74-84)

4.2 Walking Speed

Walking speed or gait velocity is a reliable, sensitive, valid and specific measure that correlates with balance, confidence and functional ability of an individual. Appropriate walking speed is a prerequisite for independence and survival in living environment (Valtiokonttori 2005). Future health status and functional decline, including mortality, institutionalization, discharge location can be predicted by it. Gait velocity reflects both physiological and functional changes. It is a discriminating feature in verifying potential for rehabilitation, assists in fall prediction and fear of falling. Besides that, progression in walking speed has been connected to clinical meaningful changes in life quality. (Mangione et al. ... 2008, 10-18; Purser, Weinberger & Cohen 2005, 535-546; Schmid, Duncan & Studenski 2007, 2096-2100; Steffen, Hacker & Mollinger 2002, 128-137; Studenski, Perera & Wallace 2003, 314-322)

Gait velocity varies by gender, age and anthropometrics (weight, height, hand length etc.), but range for normal gait velocity is between 1.2 m/sec and 1.4 m/sec. For patients with abnormal walking speed, an improvement of at least 0.1 m/s is a useful predictor of well-being, while decrease in the same amount indicates poor health status, increased disability, longer hospitals stays and as a consequence increased medical costs. (Hardy et al. ... 2007, 1727-1734; Purser, Weinberger & Cohen 2005, 535-546)

Walking is a complex functional activity and is thus influenced by such variables as energy, movement control and coordination, which in turn, requires the proper functioning of multiple body systems, including nervous, musculoskeletal and cardiovascular systems. Normal walking requires adequate strength of lower extremities, smoothly functioning joints, healthy nerve impulse conduction, and dynamic balance ability (Valtiokonttori 2005). Cross-sectional studies have revealed that a large proportion of falls in elderly happen while walking. Significant changes in gait patterns were also established. The most consistent finding of the studies was that elderly individuals walk slower than younger ones due to a shorter step length and increased time spent in double limb support. These age-related changes in walking patterns have been shown to be risk factors for falls. Thus gait velocity as a

screening tool could be used to access insight into the client's functional capacity and safety. (Fredman, et al. ... 2006, 1074-1081; Gerin-Lajoie, Richards & McFadyen 2006, 364-369; Ostchega et al. ... 2004, 977-982).

5 PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study is to find out how 12-week gym exercise training held in Nakkila fitness center affects walking speed and hand grip strength of elderly adults.

The intervention consists mainly of the exercises that focus on muscle strength, and endurance. Evaluation of the participants' physical condition before and after 12-week training period has been carried out by conducting structural interviews and performing functional measurements: Isometric Hand grip test and Ten-Meter-Walk test.

The study hypothesis predicts a difference between functional measurements of hand grip strength and walking speed of the participants before and after the 12-week exercise programme. However, it is not specified what kind of difference there will be. To find the answer to this two research questions are formulated.

1. How does 12-week training programme affect walking speed of elderly adults?
2. How does 12-week training programme affect hand grip strength of elderly adults?

The study aims to unveil whether 12-week exercise training progamme organized by the municipality of Nakkila is effective for the health of the elderly inhabitants and should be continued after the project ends.

6 RESEARCH METHODOLOGY

In this study a descriptive non-experimental research method with qualitative and quantitative data collection was used. Descriptive research is concerned with describing, recording, analyzing, and interpreting the existing conditions. It involves some type of contrast or comparison and makes an effort to discover relationship between existing non-manipulated dependent and independent variables (Kumar 2002, 24). Dependent variable is the variable of principal interest to the investigator. It is in contrast to the independent variable that is known or thought to be at least predictive if not actually causative of the dependent variable. In the present study the independent variable is the 12-week exercise training programme, and the dependent variable are the values of the functional measurements and the participants' thoughts, feelings and ideas about the 12-week exercise training period.

6.1 Implementation of the Study

The area of research for this study was received in January 2011. One month after that was spent for preliminary literature search and developing of the thesis outline. On the 8th of February 2011, the 1st meeting with the project parties (the owner of Nakkila Fitness Center and the physiotherapist responsible for this project) took place. During the meeting the following issues were discussed: purpose of the project, thesis aim, participants' description, data gathering methods, training schedule for the participants, training facilities of the gym dedicated for the project. Two weeks after the meeting were spent on planning the measurement tools: interviews and functional tests. The expert's evaluation (physiotherapist, responsible for the project) of the measurement tools (interviews and functional tests) was performed to assess whether they are relevant and appropriate in terms of construct, and whether the items adequately measure all dimensions of the construct and are comprehensible for the participants (Polit & Beck 2004, 423). On the 1st of March 2011 the agreement on the thesis preparation was signed up. On the same date the preliminary interviews and functional tests were performed.

For the next 12 week-period from the 3rd of March till the 19th of May 2011 participants of the study had training sessions twice a week on Tuesdays and Thursdays. The researcher visited the training sessions twice to greed the examinees, check and observe the training process and the attitudes of the participants. The first visit was made during the third week of training, and the second visit was paid after six weeks of exercising. On the 19th of May 2011 the final data was collected through the interviews and the functional tests. On the 15th of June 2011, the thesis writer had a supervision session with the project physiotherapist to discuss the results and share opinions about the training process. Thesis writing process (literature review, data analysis, supervision sessions with the thesis tutor) was completed during the period from March 2011 till June 2012. A timeline summary of the thesis process is shown in Appendix 1.

6.2 Methods of Data Collection

Qualitative research and quantitative research offer different perspectives on the problem and each has its limitations. Qualitative data offers a detailed understanding on the research area, whereas quantitative data provides more general information. When many individuals are examined quantitatively, the understanding of any one individual is reduced. When few individuals are studied qualitatively, the ability to generalize the results to many is lost. Hence the limitations of one method can be counterbalanced by the strengths of the other one, and the combination of quantitative and qualitative date provides more detailed perception on the research problem than either approach by itself. (Creswell & Plano Clark 2011, 8) For this reason in the present study the ad hoc combination of quantitative and qualitative research methods or a mixed methods research was used in order to broaden the dimensions and the scope of the project, to obtain a more complete picture of participants' performance and experience, thus be able to better answer the research questions (Andrew & Halcomb 2009, 3; Tashakkori & Teddlie 2003, 189). The process of the mixed methods research is demonstrated in Figure 2. It should be noted that although the process steps are numbered, they can be followed in a different order as the needs of the researcher change or as problems arise that must be addressed (Terry 2012, 111-112).

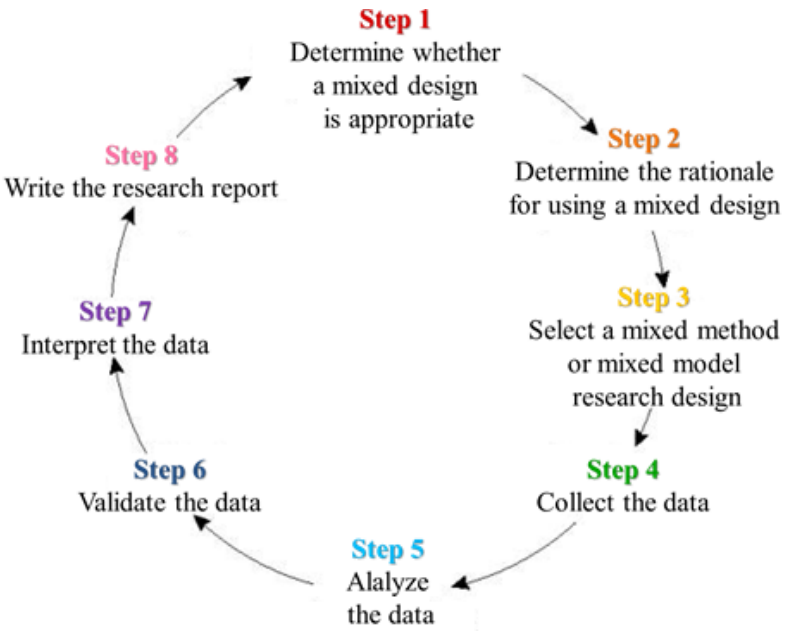

Figure 2. Stages of the mixed methods research process (Terry 2012, 111-112).

The convergent parallel expansion design was chosen to work with the data in this research. In this type of design qualitative and quantitative data are collected in parallel, analyzed separately, and then combined into an overall interpretation (See Figure 3). The intent in using this design is to combine the two forms of data to bring greater insight into the problem than would be obtained by either type of data separately (Creswell & Plano Clark 2011, 77). The results of such studies are often presented in a side-by-side fashion, rather than woven together into a single story (Polit & Beck 2004, 279).

For this study in terms of the quantitative data, two functional measurements for each participant were performed. When analyzing the quantitative data, the researcher calculated descriptive statistics and group comparisons to see whether significant differences existed between the pre-assessment functional measurements and the normal range scores and for the results before and after the 12-week exercise period.

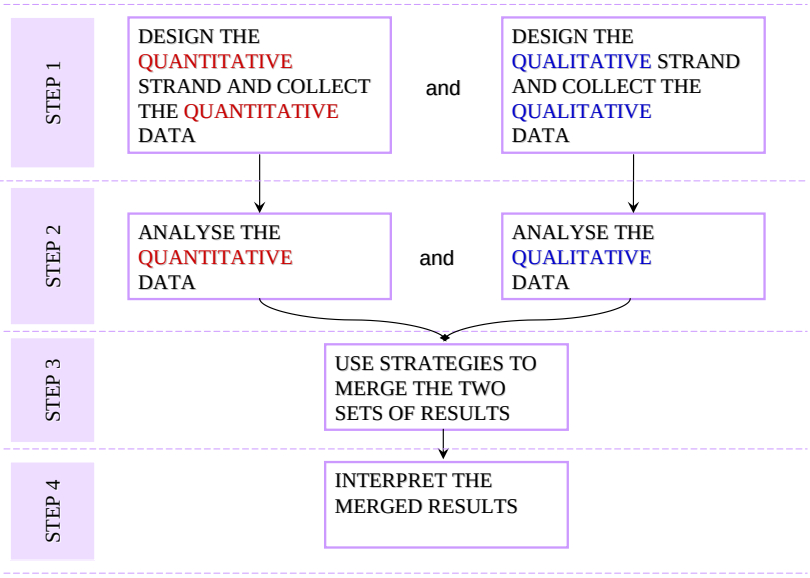

Figure 3. Flowchart of the Basic Procedures in Implementing a Convergent Parallel design method (Creswell & Plano Clark 2011, 77).

The research also included the qualitative structured interview on the participants' functional capacity in carrying out activities of daily living and mobility, and semi-structured interview about the participants' thoughts, feelings and ideas about the 12-week exercise training period. The pre-interviews were analysed statistically, and the post-interviews were examined by qualitative content analysis with deductive approach.

6.3 Operating Environment

This research was conducted in Nakkila Fitness Center, the owner of which took dominant role in planning and organizing the whole project. Nakkila Fitness Center (NKK) opened in September 2010 in the municipality of Nakkila. It offers wide range of services to people of all ages regardless their fitness level, background or gender. For the senior clients there are specially adapted gym machines that are easy and safe to operate, even if the user has diminished sight, strength and balance (Website of Nakkila Fitness Center 2011). This gym equipment was used during the 12-week exercise training period by the participants of the study.

6.4 Subjects

The present study included seven residents of the municipality of Nakkila aged 70-86. All of the participants were the clients of the municipal health care system currently living at their homes. All of the subjects used the services of the municipal physiotherapist, who was selected to lead the 12-week gym exercise training. The sample size selection was made by the municipality of Nakkila, who sponsored the project. The physiotherapist knew the physical condition of the participants, and personally recruited all of them to take part in the project. The subjects were volunteers, mentally capable of understanding and performing the tests proposed, and ambulatory with and without aids (Polit & Beck 2004, 290). All gave their informed consent for participating in the study.

6.5 Exercise Programme

The exercise programme was developed by the municipal physiotherapist, specialized in physical fitness training for the elderly. The same physiotherapist was instructing and leading all of the exercise training sessions. The intervention consisted of two one-hour sessions per week for 12-week period. According to the research, resistance training lasting from eight weeks to one year can increase muscle strength and mass in the elderly, regardless of age and gender (Ehrman, Gordon, Visick & Keteyian 2009, 145). Thus the period of 12 weeks for this exercise training programme was considered to be sufficient. Although most strength training studies propose three strength workouts per week, some research indicates that two strength training sessions per week may be as effective (Baechle & Westcott 2010, 17). Hence for this study training twice a week was thought of to be sufficient.

Every session began with a ten-minute warm up in a form of chair exercises, which were chosen for the reason that not all of the participants could stand for a long time. The rest of the session consisted of circuit training with 12 exercises machines that were chosen to train cardio-respiratory endurance, and muscle strength of shoulder-, arm-, back-, chest-, legs- and buttock areas. Subjects were asked to perform as many repetitions as possible with one to two minutes rest between the machines. The

exercise machines were individually adapted for each participant, according to his or her needs and physical condition. Some clients did not use all 12 exercise machines during the implementation due to personal physical limitations and medical restrictions. Each session was finished with a ten-minute cool-down with stretches for the major muscle groups used during the exercise. (Fleck & Kramer 2004, 319)

6.6 Assessment Procedures

Assessments were made before subjects began the exercise program and after the 12-week period. Assessments included two functional measurements: Isometric Hand Grip test and Ten-Meter-Walk test. Structural interviews were used before the 12-week exercise period to measure functional capacity in carrying out activities of daily living and mobility. At the end of the study semi-structured interviews were applied to assess the participants' thoughts, feelings and ideas about the 12-week exercise training period. Each participant test session took approximately 45 minutes. Three persons participated in collecting the data: the thesis writer was conducting the interviews, the physiotherapist was carrying out the tests and the project organizer/owner of the fitness center was measuring blood pressure and heart rate of the subjects to assure that it was safe for them to begin the exercise programme.

6.6.1 Structured Interview

The structured interview was conducted before the exercise training programme. Its purpose was to collect background information of the participants' and to provide general description of their mobility level and capacity to carry out activities of daily living. The design of the interview is shown in Appendix 4 and Appendix 5.

The structural interview was created on the basis of the questionnaire ("peruskysely" U0078) used in the AGE-project ("IKÄ-hanke" held during 2002-2008 in several municipalities in Finland) to assess elderly person's capabilities, need for assistance and access to it, social relationships and physical activity level (Kansaneläkelaitos 2009; Wallin & Vaara 2003).

The structured interview had set of standardized closed-ended questions, from which the informant was supposed to choose the one that most closely matched the appropriate answer. This interview structure ensures a certain amount of control over issues discussed with the participants, and makes it easier to be quantitatively analyzed. The face-to-face form of the interview implementation was selected in order to obtain a higher response rate. (Kansaneläkelaitos 2009; Polit & Beck 2004, 235)

The structured interviews were carried out at Nakkila fitness centre in a quiet room that offered privacy (Polit & Beck 2004, 333). The interviews were conducted in Finnish- native language of the informants. The answers to the interview questions were documented by taking detailed notes of what participants had told (Polit & Beck 2004, 333). Each interview lasted approximately 35 minutes. Prior to the interview the researcher introduced herself, and shortly told why the information was collected and how it would be used. All the informed consent forms (Appendix 2 and Appendix 3) were signed by the participants. (Gray 2004, 222)

6.6.2 Semi-Structured Interview

Semi-structured interview was selected for this study, since it assists in obtaining descriptive information of the events that need to be investigated for the research purposes (Seale & Barnard 1998, 56). Semi-structured interviews were carried out after 12-week exercise training programme. The purpose of these interviews was to assess participants' thoughts, feelings and ideas about the 12-week exercise training period. The interview design is presented in Appendix 6 and Appendix 7.

In advance to the semi-structured interviews written topic guide with a list of open-ended questions to be covered with each participant was prepared. This was done to ensure similarity of issues discussed in all interviews, and to guarantee certain amount of control over issues discussed with the examinees. During the interviews the participants were encouraged to talk freely about all the topics on the list, and to respond in their own words, providing as much detail as they wish. However, participants were also encouraged to explore other issues that were outside the guide

as long as they were still relevant to the overall project. (Polit & Beck 2004, 341-342)

The participants were interviewed at Nakkila fitness center in a quite area that offered privacy (Polit & Beck 2004, 333). The interviews were conducted in the native language of the informants-Finnish. The answers to the interview questions were recorded by taking detailed notes of what participants had said (Polit & Beck 2004, 333). The average duration of the interview was 30 minutes. Prior to the interview the researcher asked whether the participants had any further question related to the study since the time of the pre-interview. All the informed consent forms were received in written form. (Gray 2004, 222)

6.6.3 Functional Measurements

In order to evaluate functional capacity of the study participants' Isometric Hand Grip and Ten-Meter-Walk tests were performed before and after the 12-week exercise programme. Important feature of these functional measurements is that they have accompanying performance standards for evaluation test results. Specifically, there are four-year age group norms for men and women, ages 70 to 89, on both tests, thus making it possible for individual to assess their scores relative to others of the same age and gender. Data for the norms were obtained from a Finnish nationwide study conducted in co-operation with Finnish State Treasury and the University of Kuopio in 2001, involving approximately 2600 older adult volunteers, undergoing treatment in the biggest rehabilitation centres in Finland. Table 1 indicates normal range scores for men and women for both tests, with "normal" defined as the middle 50% of the population. Participants scoring above the normal range would be considered 'above the average' for their age, while those scoring below the range would be "below average". (Valtiokonttori 2005)

Isometric hand grip test was performed with Jamar hand dynamometer. For the starting position the client was asked to sits on the chair without arm rests with his or her back touching back of the chair. The client was told to holds the dynamometer in the hand to be tested, with the arm bent at right angle on the elbow without squeezing

the arm against the body. The width of the handle was adjusted to the size of the hand to make sure that the middle phalanx rested on the inner handle. The examinee was allowed to perform one test trial. After this, two trials followed and the best score was used for analysis. Hand grip strength was expresses in kilogrammes (kg) with 0,1 kg accuracy. (Valtiokonttori 2005)

Table 1. Normal range of scores for men and women (Modified from Valtiokonttori 2005).

Measurements	*Age groups (years)*			
	70-74	*75-79*	*80-84*	*85-89*
Normal range of scores for men				
Isometric Hand-Grip test dominant hand (kg)	*39*	*35*	*34*	*30*
Isometric Hand-Grip test non-dominant hand (kg)	*36*	*34*	*31*	*28*
Ten-Meter Walk test (s)	*6*	*7*	*8*	*10*
Normal range of scores for women				
Isometric Hand-Grip test dominant hand (kg)	*24*	*24*	*23*	*20*
Isometric Hand-Grip test non-dominant hand (kg)	*22*	*22*	*20*	*15*
Ten-Meter Walk test (s)	*7*	*8*	*8*	*10*

Ten-Meter Walk test took place in a hall with markers placed at distances of 2, 12 and 14 meters (See Figure 4). The client was instructed to walk as fast as he or she safely could until the researcher said to slow down. To ensure the client's safety, the instructor followed the examinee through the whole walking path. The participant was asked to walk 16 meters but the time was measured for the intermediate 10 meters, starting when the toes of the leading foot crossed the 2-meter mark and stopped when they crossed the 12-meter mark. The first 2-meter distance and the last 12-meter distance were used to allow for acceleration and deceleration respectively. Assistive devices were used as required and this was recorded. The test's time was taken by a stopwatch and marked with 0,1 s accuracy. (Valtiokonttori 2005)

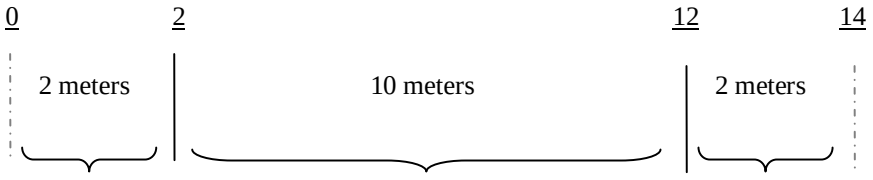

Figure 4. Visual illustration of the walking path (Valtiokonttori 2005).

6.7 Reliability and Validity of the Measurement

The two most important and fundamental characteristics of any measurement procedure are reliability and validity. Reliability refers to the consistency and accuracy of information obtained in a study. The term is most often associated with the method used to measure research variables (Polit & Beck 2004, 35). Validity is a more complex concept that broadly concerns whether the findings are cogent, convincing, and well-grounded. The validity questions whether the methods are really measuring the abstract concepts that they purport to measure. (Polit & Beck 2004, 36)

The quantitative part of data collection in this study is represented by functional measurements-the measurements that assess the physiological status of the study participants and evaluate clinical outcomes (Polit & Beck 2004, 398). The functional measurements used in this study include quantified numerical readings from the utilized equipment: a blood pressure monitor, a weight scale, a stopwatch, and a handgrip dynamometer, which provided valid measures for the targeted variables. Such measurements are often described as objective, relatively accurate and precise for research studies. Even these values, however, can be subject to measurement error. In order to eliminate any inaccuracy in measurements and barring the possibility of equipment malfunctioning, all the used devices were calibrated and checked prior to the measurements (Nicoll & Beyea 1997; Polit & Beck 2004, 401). The blood pressure of the participants was gathered before the function measurement tests because it increases in response to exercise (United States Department of Health and Human Services 1996, 63). Physiological data was also obtained by self-report rating scale. It was the only mean of obtaining the information on the physiological phenomenon-pain, experienced by the subjects and non-observable or immeasurable by the researcher (Polit & Beck 2004, 412).

The observational measurements in the form of structured interviews were used for both quantitative and qualitative data collection. Structured interviews were chosen for this study as they are considered to have strong reliability and allow the researcher to explore greater depth of meaning than can be obtained with other techniques (Burns & Grove 2001, 422). The question of validity is raised in the

context of the form of the investigation, its purpose, and the population for whom it is intended. The components of validity include face, content, criterion-related and construct validity. Face validity, is the assessment of the measurement tool, in this case the structured and semi-structured interviews. The interview questions were carefully reviewed to make sure that the questions were clear and unambiguous. The expert review with the physiotherapist, responsible for the project, was performed to eliminate any misunderstanding. Content validity ensured that an instrument (interview) has an appropriate sample of items for the construct being measured (Polit & Beck 2004, 423). When creating the interview questions, the researcher made sure that they had the capacity to answer the research questions. Criterion-related validity or predictive validity involves determining the relationship between an instrument and an external criterion. The later performance is called the criterion and the current score is the prediction (Polit & Beck 2004, 424-425). The research questions were formed in a way that enabled the researcher to assess what was aimed to be evaluated, and predict the outcomes of some aspects of this study. Construct validity is the extent to which an instrument (interview) measures the concept or construct that it is proposed to measure (Polit & Beck 2004, 425). In the present research the questions and theories used were associated and reinforced by previous studies.

6.8 Data Analysis

In the present study the data analysis was accomplished by using both quantitative and qualitative methods. Quantitative procedures included statistical analysis of the pre-interviews and the functional measurements. Qualitative analytic procedure was comprised of deductive content analysis of the post-interviews.

6.8.1 Statistical Analysis

In this research descriptive analysis and inferential statistical analysis were utilized. Descriptive statistics is used to describe the basic features of collected data in a

study. It is typically distinguished from inferential statistics, in that descriptive statistics aims to summarize a data set, rather than uses the data to learn about the population that the data are thought to represent. (Polit & Beck 2004, 451, 477)

In this study descriptive statistics was used in a form of percentages to analyze the pre-interviews. The pre-interviews were structured as a category scheme with codes in form of answers. The coded data was transferred into a spreadsheet of Microsoft Excel®, and analyzed by Tixel statistical software package. This data analysis was performed to describe and analyze what had been found about the background information of the subjects.

To analyze functional measurements both descriptive and inferential statistics were applied. In the descriptive part of the analysis the mean ($\bar{x}$) and the standard deviation (*SD*) were calculated. Mean is the index of typicalness of a value in a population, usually referred to as an average. Standard deviation indicates the average amount of deviation of values from the mean, and, as well as the mean, is calculated using every score in a population. (Polit & Beck 2004, 459-462)

The numerical differences between the results obtained during the pre-assessment functional measurement tests and the normal range scores, and the pre- and post-assessment functional measurements were calculated manually. The obtained data was entered into a spreadsheet of Microsoft Excel® and analyzed by Tixel statistical software package.

To determine whether any of the test results had statistically significant changes the inferential statistics represented by the paired two-tailed t-test was applied. Paired t-test is often used to compare scores of the same sample from before and after an intervention to determine whether significant change has occurred (Asthana 2007, 101). A two-tailed test is conducted if the hypothesis predicts a difference between two sets of data but does not specify the direction of the difference between them (Martin & Thompson 2000, 25). In this research it was predicted that there will be a difference in the functional measurements before and after the 12-week exercise programme, however it was not specified what kind of difference and how big or small it will be. The level of significance determines the probability of the decision to accept or reject the hypothesis as being correct. The usual levels of probability (*p*)

are $p < 0,05$ and $p < 0,01$. This means that the probability of the result falling in the rejection region (area in which a result forces a researcher to reject the hypothesis) is five per cent (5 in 100) or one per cent (1 in 100) (Martin & Thompson 2000, 285). Therefore a two-tailed test that obtains a result with a significance level of $p > 0,05$ would lead the researcher to conclude that there was no statistically significant difference between the sets of data, and the result has to be interpreted as statistically non-significant (Martin & Thompson 2000, 26). The obtained data was entered into the Tixel statistical software package, which automatically tabulated the probabilities of the results falling in the rejection regions.

6.8.2 Deductive Content Analysis

In this study qualitative content analysis with deductive approach was used to examine the data gathered from the post-interviews. Content analysis is known as a process of evaluating the content of narrative data to identify prominent themes and patterns among the themes. This process involves breaking down data into smaller units, coding and naming the units according to the content they represent, and grouping coded material based on shared concepts (Polit & Beck 2008, 517-518). The content analysis is used when data is evaluated objectively and systematically. Its purpose is to describe the phenomenon of interest in a condensed and general form. (Kyngäs & Vanhanen 1999, 3-12)

In the deductive approach of content analysis the classification of the data is based on an earlier framework which can be a theory or a concept system. The process of analysis is guided by a theme or a mind map. When a deductive content analysis is chosen, the first step is to create a base for the analysis. After it has been developed, all the data are reviewed for content, and only the aspects that fall within the frame of analysis are chosen from the data. (Latvala & Vanhanen-Nuutinen 2001, 21-43; Marshall & Rossman 1995, 23-41; Sarajärvi 2002, 51)

For data collection in the post-interviews semi-structured open-ended questions were used, the answers for which were written down by the researcher. Before data evaluation the units of analysis and the categories into which these would be placed

were defined. Three main categories were the outcome of this process. The main categories were labeled: “Reasons for joining the project”, “Effectiveness of the project”, and “Evaluation of the project”. The semi-structured framework of data collection helped the researcher to collect only the matters which fell into the chosen categories, which made the process of data analysis easier.

7 RESULTS

For this study the total amount of training sessions was 24, including the pre-and post-assessment measurements, which took part on the first and the last sessions, respectively. Exercises were held twice a week on Tuesdays and Thursdays for the period of 12 weeks. There were two male (28,6%) and five female (71,3%) participants in the study. Four (57%) out of seven testees took part in all of the 24 training sessions (See Table 2). For the whole training the mean presence of the participants was 88,7%. The reasons for being absent included: flue, doctoral appointments and travelling.

Table 2. Presence of the participants during the whole training period.

Participants: m = male f = female	*Times of being absent*	*Being present (%)*
A-f	*0*	*100*
B-f	*0*	*100*
C-f	*0*	*100*
D-m	*10*	*58,3*
E-m	*8*	*66,7*
F-f	*0*	*100*
G-f	*1*	*95,8*
2m / 5f		*($\bar{x}$) = 88,7*

7.1 Background Information of the Subjects

The background information of the subjects is included into Table 3. The mean age (years) of the participants was 77,5 (*SD*=6,9). The average height (cm) among the study group was 165,4 (*SD*=9,8). The mean weight (kg) of the examinees was 71,0 (*SD*=14,6). The mean Body Mass Index (BMI) (weight kg/ height m^2) among the interviewees was 26,0 (*SD*=4,9).

Table 3. Standard deviation and mean values of the participant's age, height, weight, and BMI in the beginning of the study.

Measurements	*Participants (N=8)* $\bar{x}$	*SD*
Age (years)	*77,5*	*6,9*
Height (cm)	*165,4*	*9,8*
Weight (kg)	*71,0*	*14,6*
BMI (weight kg/ height m^2)	*26,0*	*4,9*

In the beginning of the study all of the participants assessed own health status as "average". Six out of seven (85,7%) interviewees had chronic diseases with regular medication. All seven examinees were pensioners and did not work anywhere for several years. Living conditions of the participants were as follows: one (14,3%) lived in the apartment buildings on the first floor, five (71,4%) lived in separate houses, one (14,3%) lived in terraced house. One out of seven (14,3%) interviewees reported living with a spouse, others (85,7%) stated living alone. None of the examinees changed their apartments during the last year.

None of the participants reported having problems when moving inside home environment. One (14,3%) interviewee mentioned slipping just once without known reasons, otherwise no falls were reported. Supported devices, such as walkers and canes were used by five examinees (71,4%) both inside and outside home environments. One participant (14,3%) notified of having an assistive toilet chair and railings inside bathroom. One interviewee (14,3%) was using safety phone at home. One senior (14,3%) used hearing device. All of the participants needed eyeglasses in everyday life. The distance to the nearest outside facilities such as a shop, a pharmacy, a bank, a post office, a health center or a bus stop was reported to be

longer than 1 km by five participants (71,4%), and between 0,5-1 km by two individuals (28,6%).

Own functional capacity was viewed as “excellent” by four participants (57,1%), as “good” by two persons (28,6%), and as “satisfactory” by one individual (14,3%). Problems with everyday activities inside home environment were experienced by one senior (14,3%) – “never”, by four participants (57,1%) –“sometime”, and by one interviewee (14,3%) –“often”. Difficulties with activities outside home environment happened to two participants (28,6%) –“sometimes”, to two examinees (28,6%) – “often”, and to three individuals (42,8%) –“never”.

Some problems with accomplishing basic activities of daily living were experienced by all participants. All of interviewees managed well with eating. Everyone was able to perform personal hygiene. However taking shower without outside help was capable of doing just five individuals (71,4%). Nail cutting was impossible without outside support for all examinees. Functional transfers to and from bed were difficult for two adults (28,6%). All seven participants were able to dress up and out themselves. Stair climbing was problematic for six clients (85,7%) and impossible for one (14,3%).

Difficulties in performing instrumental activities of daily living happened to be among the interviewees. Walking 400 m was impossible for one (14,3%) and difficult for two (28,6%) participants. Five individuals (71,4%) managed to do laundry by themselves, others needed outside help. Five (71,4%) examinees were able to cook for themselves, others used outside services or help from their relatives. Five (71,4%) participants were capable of doing light housekeeping, as dish washing. But only one (14,3%) was able to perform hard housework, like windows’ cleaning. Six individuals (85,7%) reported having no problems with paying bills, going to a shop, a bank, a pharmacy or a post office. Yet carrying shopping bags was impossible for four adults (57,1%). Medication management was impossible for two individuals (28,6%), who needed support from outside. The outside services that were used by the interviewees weekly included: homecare nursing, meal delivery, taxi, physiotherapy and house cleaning. In addition to professional care, support from relatives and friends was given to all examinees.

Exercise and physical activity was thought of as an important element in human life. All of the interviewees emphasized health benefits of the exercise. However, not everyone performed exercises daily. Two (28,6%) individuals did neither exercise nor walked outside during the week- everything was done for them. Two (28,6%) participants went for water gymnastics every now and then. One (14,3%) examinee did morning exercises daily. One (14,3%) individual enjoyed walking in own garden with a walker every day, and occasionally performing weight lifting exercises. One (14,3%) person was quite active and on a daily basis was walking for 30 minutes (biking outdoors in summer), exercising on a stationary bike for 10 minutes and doing light gymnastics for 30 minutes.

7.2 Hand Grip Strength of the Subjects

In an attempt to evaluate hand grip strength of the participants in the beginning of the study, the results obtained during the pre-assessment measurement were compared to the normal range scores from the whole population by subtracting the normal range scores of the population from the values obtained in the beginning of the study (Table 1). "Minus sign" indicates that the examinees showed poorer result than an average individual of the same age group in the whole population. The mean values and the standard deviations were calculated for both hands and are included into Table 4. The results illustrate that the examinees showed poorer hand grip strength in comparison to the average of the population on both hands. Strength of the dominant hand was poorer than that of the non-dominant for the study participants. All of the measurement values were statistically non-significant ($p > 0,05$).

Table 4. Standard deviation and mean values of the difference between the pre-assessment hand grip strength and the normal range scores.

Measures	*Isometric Hand-Grip test dominant hand (kg)*	*Isometric Hand-Grip test non-dominan hand (kg)*
$\bar{x}$	*- 6,0*	*- 5,7*
SD	*4,2*	*7,3*

In order to observe the effect of the exercises on the participants' hand grip strength, the values from the pre- and post-assessment measurements were compared by

subtracting the values obtained in the beginning of the study from the values obtained at the end of the 12-week training period. The results obtained from the post-assessment measurements are demonstrated in Appendix 8. The means and the standard deviations of the results were calculated for each hand and are included into Table 5. Improvements of the participant's performance on the isometric hand grip test were noticed on dominant hand 2,3 kg (*SD*=5,1), but not on non-dominant hand -0,9 kg (*SD*=3,0). All of the measurement values were not statistically significant.

Visual illustration of the examinee's performance on the isometric hand grip test after 12-week exercise programme is shown in Figure 5.

Table 5. Standard deviation and mean values of the difference between the pre-and post-assessment measurements of hand grip strength.

Measurements	$\bar{x}$	*SD*
Isometric Hand-Grip test dominant hand (kg)	*2,3*	*5,1*
Isometric Hand-Grip test non-dominant hand (kg)	*-0,9*	*3,0*

7.3 Walking Speed of the Subjects

Speed and time are correlated in such a way that with the decrease in time speed increases and vice versa (Jardins 2008, 88). Hence conclusions about the walking speed were drawn from the values of the time taken to walk 10-meter distance.

To evaluate walking speed of the participants in the beginning of the study, the results obtained during the pre-assessment measurement were compared to the normal range scores from the whole populations (Table 1). The comparison was done by subtracting the normal range scores of the population from the values obtained in the beginning of the study. "Minus sign" indicates that the examinees showed poorer result than an average individual of the same age group in the whole population. The mean values and the standard deviations were calculated and included into Table 6. The results illustrate that the participants' walking speed was below the average of the population. All of the measurement values were statistically non-significant ($p >$ 0,05).

Table 6. Standard deviation and mean values of the difference between the pre-assessment Ten-Meter Walk test and the normal range scores.

Measures	*Ten-Meter Walk test (s)*
$\bar{x}$	*- 3,1*
SD	*3,1*

To examine the effect of the exercises on the participants' walking speed, the values from the pre- and post-assessment measurements were compared by subtracting the values obtained in the beginning of the study from the values obtained at the end of the 12-week training period. The results obtained from the post-assessment measurements are demonstrated in Appendix 8. The means and the standard deviations of the results were calculated and integrated into Table 7. Improvement of the participant's performance on the ten-meter walk test was detected. "Minus sign' in this case indicates that the participant's spent less time on 10-meter distance -0,2 s (*SD*=1,2), hence their walking speed increased. All of the measurement values were not statistically significant.

Table 7. Standard deviation and mean values of the difference between the pre-and post-assessment measurements of Ten-Meter Walk test.

Measurements	$\bar{x}$	*SD*
Ten-Meter Walk test (s)	*-0,2*	*1,4*

Visual illustration of the examinee's performance on the ten-meter walk test after 12-week exercise programme is shown in Figure 5.

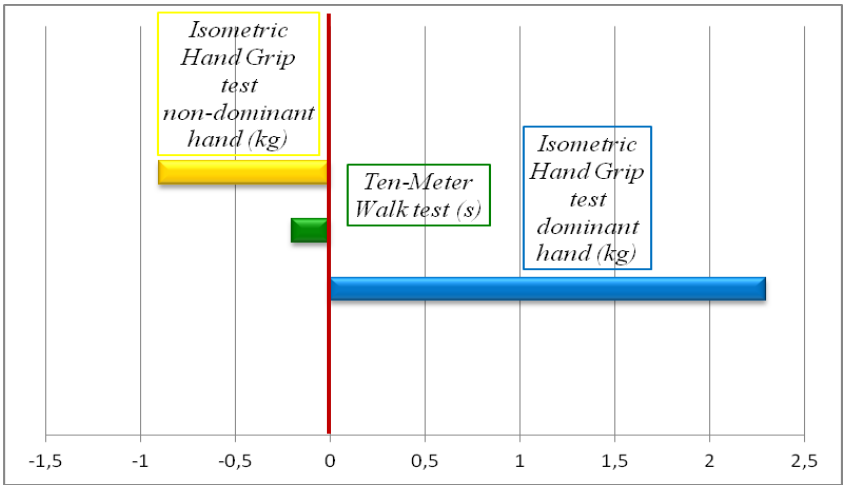

Figure 5. Mean values of the difference between the pre- and post- assessment measurements of Isometric Hand Grip test and Ten-Meter-Walk test.

7.4 Study Participants' Evaluation of the 12-week Exercise Programme

Most of the participants joined the project because of the decrease in general health condition and fitness level, and a desire to improve them. Some of the examinees wished to develop their ability to cope with everyday activities. Others wanted to feel and move better and stated that it is important to exercise.

> *"… halusin parantaa yleiskuntoani… pärjäisin kotona paremmin."*
> *("… I would like to improve the general condition… would manage at home better.")*
>
> *"… parempaa vointia…"*
> *("…better well-being…")*
>
> *"… liikunta on tärkeää …"*
> *("… exercise is important…")*
>
> *"… että kunto nousisi…"*
> *("… so that the fitness level would increase…")*
>
> *"… jaksais päivän askareissa paremmin…"*
> *("… would cope better with everyday activities…")*

All of the study participants reported that their physical condition has improved after the project. Some of the interviewees described an increase of strength in different body parts, improvements in balance and mobility. In addition, relief of pain in knees

and thighs was noticed, as well as the capability to perform such activities as carrying shopping bags, and dressing up socks, which were not possible to perform for few years.

"... helpompi kävellä ja liikkua... kevyempi paino tuntuu nyt..."
("... easier to walk and move... weight feels lighter now...")

"... liikkeet parantuneet..."
("... movements improved...")

"... voimat tullut lisää..."
("... strength increased...")

"Ylävartalon voima on kasvanut."
("Upper body strength increased.")
"... tasapainoa paremmaksi... polvi ja reidet ei ole kipeät..."
("...better balance...knees and thighs don't hurt...")

"... sukat sai jalkkaan itse..."
("...am able to put socks on the legs myself...")

"... voi kauppakassi kantaa..."
("... can carry shooping bag...")

All the comments about the programme were positive. Every examinee enjoyed the social aspect of the project. Being in a group with other individuals and communicating with them was considered important, especially for those who live alone. The participants as well enjoyed the staff members.

"...Toisten seurassa oleminen... saa jutella niiden kanssa..."
("...Being with others... can talk to them...")

"... näkyy ihmisiä... kotona niitä ei näis..."
("...can see people...cannot see them at home...")

"... mukava henkilökunta..."
("... nice personnel...")

"... hauska porukka..."
("... enjoyable group...")

All of the interviews were satisfied with the programme and would recommend it to their friends. However more exercises on the balance would be preferred.

"... miellyttää kaikkia... olen tyytyväinen."

(“… I’m pleased with everything… I’m satisfied.”)

“… tasopaino enemmän…”
(“… more balance…”)

All of the study participants would like to carry on exercising, even if the project will not have a continuation. In case it would persist, every interviewee expressed a wish to participate in it. Yet for some of the examinee the price of the service would be a defining factor. Furthermore, it was suggested to organise the exercise group during the winter season, because in summer some of the participants already do exercise, while in winter self-training is more demanding.

“Kyllä, ehdottomasti…”
(“Yes, definitely…”)

“Kyllä, luulisin… riippuu, kuinka maksaa…”
(“Yes, I guess… depends on how to pay…”)

“… kesällä tulee liikkua muuten, mutta syksyllä…”
(“… in summer I exercise anyways, but in autumn…”)

8 CONCLUSION

Quantitative results of the study demonstrate that in the beginning of the research hand grip strength for both hands and walking speed of the participants were poorer in comparison to the average of the population. After the 12-week exercise programme hand grip strength increased only for dominant hand. Walking speed of the participants improved as well after the programme was finished. However, all of the values obtained in this study were statistically insignificant on a group level. On an individual level improvements on the functional tests were established for most of the participants. But since the minimal detectable changes for hand grip strength and walking speed were not calculated for this study, it was difficult to determine whether the improvements were clinically meaningful. It was noticed that the number of participants has a major effect on the overall outcome, hence providing an inconclusive enough result that remains relatively insignificant. Thus, despite the

study demonstrates improvements in hand grip strength and walking speed, for the result to be significant, further research with a larger participant number is required.

Qualitative results of the study illustrate positive attitude of the participants towards the 12-week exercise programme. To support the improvements in hand grip strength and walking speed, the examinees reported enhancement in several significant aspects of functional capacity such as balance, mobility, pain level, muscle strength, functional performance on daily activities and overall physical condition. All of the study participants enjoyed social aspects of the programme and during the post-assessment reported having more social interactions, increased community involvement, and remarkable raise in self-esteem.

From the study results it is possible to conclude that Isometric Hand Grip test and Ten-Meter Walk test do not only give information on the hand grip strength and time taken to walk ten-meter distance, but also provide indication of functional capacity of the participants. However, it should be noted that since the exercise intervention utilized in this study is not considered to be feasible in community-dwelling elderly examinees due to insignificant results, further studies are required to conclusively demonstrate that this 12-week gym exercise training programme offers effective and statistically significant improvements in various sides of functional capacity.

9 DISCUSSION

9.1 Consideration of the Results

The findings of this study describe the effects of 12-week gym exercise training on hand-grip strength and walking speed of elderly adults. This research aimed to unveil whether 12-week exercise training progamme organized by the municipality of Nakkila is effective for the health of the elderly inhabitants and should be continued after the end of the project. The topic for this study was chosen after preliminary literature search and consultation with the interested party. It was concluded that the

information unveiled by this study was needed for utilization by the interested party. Mixed methods research was chosen for this study. The data was collected through face-to face semi-structured interviews, face-to-face structured interviews with open-ended questions, and functional measurements.

Numerous studies have demonstrated that involvement in regular physical activity is an effective way to improve various aspects of functional capacity of older men and women by decreasing and/or preventing a number of the functional declines associated with aging, and thereby improving their quality of life and extending independent living (for example: Alfieri et al. ... 2010; Brach et al. ... 2004; Buchner, Cress, & de Lateur, 1997; Judge, Underwood & Gennosa 1993). All of the mentioned studies used a controlled group to make comparisons to an experimental group in a test of an underlying hypothesis. The present study did not use a control group, since the aim of this research was to describe the degree of effectiveness of the exercise programme on hand grip strength and walking speed, and not to make comparisons between the study participants. (Polit & Beck 2004, 169, 183)

The methods of data collection utilized in this research were used in the earlier studies, and their reproducibility was considered to be efficient. Application of the methods to the present study was rather easy and did not take long time. The choice of methodology for this research was based on the previous studies, where functional capacity was assessed through participants' self-evaluation and physical assessment or functional testing. (Alfieri et al. ... 2010; Nurmmijoki 2001; Selmo 2008; Wallin & Vaara 2003)

The study sample of this small-scale research (Mean age = 77,5 years; 71,3% females), in comparison to general Finnish population, included participants with similar percentages of females (68,2%) with average age of 80 years (Statistics Finland 2011). Despite the fact that six (85,7%) informants optimistically judged own health and functional capacity, which according to Baum and coworkers (1997) indicates the strongest life satisfaction, were in a lot poorer condition (Baum, et al. ... 1997, 146). Six (85,7 %) informants had chronic diseases with regular medication, which creates sustaining barriers to extended health and longevity, making health challenging especially for elderly adults (Kart, Meterss & Meterss 1992, 32). The mean BMI index for the study participants was 26,0 kg/m^2, which according to Cook

et al., is within acceptable healthy weight range for both males and females over 70 years of age, indicating decreased level of malnutrition and mortality (Cook, Kirk, Lawrenson & Sandford 2005, 315). In this study all of the participants had problems with performing ADLs and IADLs, which indicates that in the long run many of them will be house bounded, in need of major assistance, and perhaps be at risk of institutionalization (Kart, Meterss & Meterss 1992, 35-37). Two (28,6%) informants were physically passive, and five (71,4%) performed light training for about 30 minutes every day. Yet, all of them considered exercise and physical activity as an important element in human life. Therefore, all of the participants joined this project with a desire to improve general health condition and fitness level to be able to cope with activities of daily living safely, independently without undue pain or fatigue for as long as possible.

Training sessions in this study were implemented twice a week, which is one workout shorter than recommended by some strength training textbooks (Baechle & Westcott 2010; Earle & Baechle 2004; Fleck & Kramer 2004). However, according to the research by Demichele et al. (1997) and Westcott (2009) two exercise sessions per week appear to be especially productive for developing strength in adults over the age of 50 and produce as much muscle development as three workouts per week, in contrast to the once-a-week training, participants of which did not show significant strength gain. In the present research the dose-response relationship of training intensity to training effect has not been deeply studied. However, based on the study results it could be concluded that in response to decreased (missed scheduled exercise sessions) dose (training intensity), study participants' performance on the functional tests after 12-week training period was poor.

The study results established improvements in hand grip strength and walking speed for some participants on an individual level. All of the values obtained from the functional measurements, however, were statistically non-significant on a group level, which could be due to small study sample size. This statement implies that there was insufficient weight of evidence to be able to state that the observed difference (between the values of pre-assessment functional measurements and the normal range scores, and between the values of pre- and post-assessment functional measurements) is unlikely to have arisen by chance. Yet, it does not indicate that

there is ‘no clinically important difference between the obtained values’, because even if a clinically relevant difference was truly present, the too small size sample was very unlikely to obtain a significant *p*-value. Hence it could be concluded that the question of the measurements’ differences remains unresolved and needs additional research. (Martin & Thompson 2008, 24-42)

The exercise programme was found to be safe and well tolerated for the study participants, with no medical incidents occurring. It was implemented using existing facilities and services in the community, meaning that it is likely to be maintainable and transferable to other settings. The level of satisfaction with the programme was high, in that all of the subjects would like to carry on exercising, even if the project will not have a continuation, and in case it continues, the study participants would like to take part in it and would strongly recommend the project to their friends. Factors that may have played roles in ensuring that the program was successful included: exercise classes held in venues that were easily accessible, transportation ordered towards and from the training sessions, classes run by personnel trained in running such programs for older people, rationale for the study and the assessment measures explained clearly to the subjects, feedback provided to all participants regarding their performance in the tests at the completion of the programme, and constant supervision during the training sessions. Thus, this programme meets many of the criteria of effective health promotion interventions, particularly, adaptation, implementation, efficacy and maintenance. (Glasgow, Vogt & Boles 1999)

The increase in grip strength of dominant hand on the tests is consistent with the published studies and supports the suggestion by Justine and coworkers (2011) ‘that exercise interventions, which incorporate the elements of multicomponent exercise training”, improve hand grip strength in older persons (Justine, Hamid, Mohan & Jagannathan 2011). Even though there was no increase in the grip strength of the non-dominant hand, the study participants reported improved capacity in performing basic gripping tasks such as carrying shopping bags and dressing up, which were considered to be important activities of everyday life.

In previous studies, similar in implementation to the present research, it was reported that performance on Ten-Meter Walk test is a marker of frailty and thus is a potentially useful predictor of functional decline in community-dwelling elderly.

Walking speed diminishes with age and is related to negative events such as falls, declines in activities of daily living, deficit in instrumental activities of daily living and other morbidity. The findings of the current research show decreased duration of 10-meter walk and hence increased walking speed in the study participants after the 12-week training programme. Furthermore, during the final interviews the informants mentioned noticeable enhancement in balance and mobility. (Drusini,Eleazer & Caiazzo 2002; Michikawa et al. ... 2009; Vellas et al. ... 1997)

In addition to physiological improvements, 12-week exercise training programme offered psychological benefits. All of the study informants enjoyed the social aspect of the project. For most of the participants, especially for those who lived alone, exercising in a group with other individuals, communicating and interacting with others were considered to be important. Earlier researches demonstrated that many elderly individuals suffer from depression, anxiety and other mental illnesses, which are usually exacerbated by loneliness, isolation from family and friends, feeling of needlessness in society and financial struggling. It has been demonstrated, however, that regular exercise training significantly and beneficially affects depression, mood, self-esteem and the quality of life of the elderly. The practical implication of this, from a public health perspective, is that exercise can be an accessible, low-cost non-pharmacological treatment for depression. (Aurélio, Peluso, Silveira & de Andrade 2005; Moore et al. ... 1999; Penninx et al. ... 2002.)

There are few limitations that need to be acknowledged and addressed regarding the present study. Since the present research focused exclusively on the community-dwelling elderly of the municipality of Nakkila the findings cannot be generalized beyond that particular group. Random assignment was not possible because joining the project was voluntary. Hence, the sample was quite heterogeneous with the youngest subject of 70 years and the oldest of 86 years, the performances of which were significantly different and could not be compared to each other (Cook, Kirk, Lawrenson & Sandford 2005, 315). The sample size was small, which reduced the possibility to generalize the results to the elderly home health care users at large (Polit & Beck 2004, 300-301). Another important limitation of the study is the absence of a comparison or control group, which was impossible due to an insignificant amount of participants.

Furthermore, exercise sessions, although guided by the professional, were neither individually planned nor focused on improving particular functional limitations specific for each elderly participant. Training exercises lacked individualization in the amount of loads, doses and duration needed, and were guided by the clients themselves based entirely on their feelings. Moreover, the workout sessions were not purposefully focused on training and improving the tested variables: hand grip strength and walking speed. They rather aimed at introducing regular exercise routine into the lives of the study participants and making them more active. This poorly pre-planned programme definitely influenced the result of the study in a negative way.

Additionally, language may have been a barrier that affected the results to some extent, especially during the interviews' conduction. There was a possibility that the informants' comprehension of the questions and the researcher's understanding of the responses could have affected the reliability of the results. However, the participants were aware of the fact that the researcher was not a native speaker, and provided answers at a slow pace to avoid misunderstanding.

Minimal Detectable Change (MDC) is an important characteristic used to determine whether the amount of change as measured by the clinical outcome instrument exceeded measurement error for the instrument in a particular application. In the present study MDC was not used for evaluating hand grip strength and walking speed. Hence it is difficult to determine whether the change in hand grip strength and walking speed of the study participants was true and clinically meaningful. (Kolt & Snyder-Mackler 2003, 212)

Regardless the limitations this study has interesting findings. In addition to the fact that, improvements were noticed on the functional measurements, the study participants reported improvements in several important aspects of functional capacity such as balance, mobility, pain level, muscle strength, functional performance on activities of daily living, and overall physical condition. The positive social effect of the training programme should be mentioned as well. These facts demonstrate that exercise can play an important role in improving capability to perform daily activities in at-risk community dwelling older adults. The high adherence and adoption rates indicate that exercise interventions of this kind may

offer an effective health promotion strategy, with potential for improving quality of life and reducing health care costs. Since the programme used existing community services and facilities it is likely to provide a model for an effective and sustainable public health intervention. However, it should be noted that the exercise intervention utilized in this study is not considered to be feasible in community-dwelling elderly participants due to insignificant results. Hence further studies are required to conclusively demonstrate that exercise training programme offers effective and statistically significant improvements in various sides of functional capacity.

9.2 Ethical Considerations in the Study

Ethics guides any research with human beings. It pertains to doing good and avoiding harm by utilizing appropriate ethical principles. The ethical principles usually associated with research are: veracity, beneficence, non-maleficence, justice and confidentiality. (Moule & Doodman 2009, 57; Rai & Porter 2009, 1)

Veracity is the ethical principle associated with telling the truth. Prior to research the participants must be informed of potential risks and benefits of the study, as well as be able to agree or disagree on the their participation in the research without any coercion, and have a right to withdraw from the research at any time. This principle also includes the duty of the researcher to respect patients' rights, autonomy and dignity. The principle of beneficence refers to the practice of preventing harm by maximizing benefits for the participants and the society, while minimizing any associated risks. Non-maleficence is the ethical principle of protecting the weak, vulnerable, and incompetent research participants from social, physical, emotional, psychological and economical harms by adapting procedures and preventive processes. The principle of justice is about providing fair, equal and non-discriminatory (on the grounds of gender, religion, age, race, sexual orientation or social class) treatment for the study participants. This principle also indicates that the interests of the researcher and the study objectives must come after those of the participants'. The principle of confidentiality states that the research data about the study participants should be stored safely and never be reported without that individual's explicit permission. This principle also includes the duty of the

researcher to tell the participant who will have access to his or her data and that distribution the data with others is only allowable with the participant's approval. (Moule & Doodman 2009, 57)

Throughout the research process I followed the ethical guidelines. I was maximally honest with the participant in telling them their rights and duties as participants. Prior to the interviews and the functional measurements, I described the study's aim, purpose and objectives, and mentioned my responsibilities in the research. The informants' rights, autonomy and dignity were respected in a way that the participation in this study was voluntary and the participants were informed that they could withdraw from the research at any time even though they had assigned the consent form. During the research every effort was made to ensure that the subjects were not hurt by any means. The confidentiality was considered while performing the interviews and the functional measurements by conducting them in a quiet room that offered privacy (Polit & Beck 2004, 333). I ensured that all the data collected from the participants stayed anonymous and would be destroyed according to the regulations after publishing the thesis.

As soon as the permission to conduct the thesis was received, the agreement on preparation of the thesis was signed with the representative of the interested party (physiotherapist responsible for the project). The thesis plan, the pre- and post-interview questions and the functional measurements were sent to the physiotherapist in charge of the project via electronic mail prior to the research. The consent forms, as well as the interview questions were translated from English to Finnish, and Finnish was the language used during the interviews, functional measurements and the instructions, for the reason that the participants were able to communicate only in Finnish.

9.3 Trustworthiness in the Study

Quality is an essential characteristic for both qualitative and quantitative researches. The concepts of validity, reliability and objectivity often used to describe the desirable characteristics of both the process and the product of the quantitative

research, are considered somewhat parallel with the notion of trustworthiness in qualitative research. The elements of trustworthiness involve: credibility (the qualitative researcher's alternative to internal validity), transferability (the qualitative researcher's equivalent to external validity), dependability (the qualitative researcher's analogous to reliability) and confirmability (the qualitative researcher's alternative to objectivity). (Tappen 2011, 153)

Credibility ensures that the study findings are compatible with perceptions of the study participants. The principle of credibility can be established, for example, through prolonged engagement and persistent observation, by asking the peer to provide evaluative feedback on the preliminary conclusions of the study, by reporting cases that are opposite to what seems to be prevailing themes, and by using multiple methods for data collection. (Tappen 2011, 155-159)

In the present study the researcher familiarized herself with the participants prior to the first meeting in order to prepare for the interviews, which were conducted in a deliberative manner so that to provide the informants with sufficient time to think about the answers. The data for this study was obtained from both interviews and functional measurements, which offered more detailed perception on the participants' performance and experience. All of the interviews were conducted in Finnish, the only language spoken by the informants. Both positive and negative findings were reported and carefully analyzed in this research. After the data collection, the evaluative feedback on the preliminary conclusions of the study was asked and later on discussed with the physiotherapists, responsible for the project. (Creswell & Plano Clark 2011, 8)

Transferability refers to the suitability of the findings to other situations and other people. For the present study the purposefully selected sample was used. The findings were analyzed both quantitatively through statistical methods and qualitatively by content analysis. Conclusively, the researcher made connections between the research findings and those from other studies, by making careful comparisons across settings and people. (Tappen 2011, 160)

Dependability of the study can be established by using an inquiry audit, which is a record of the study, the investigator's decisions and thoughts created while the

research is being done. By recording a summary of the activities in which the researcher took part in during a study, makes the research writing process more visible and open for examination by possible consumers of the research. During the present study all the field notes, coded data, collected information about the participants, interview forms, documents and articles related to the study were collected and carefully kept throughout the thesis writing process. During the research course the investigator was keeping a thesis process diary to describe the processes of data collection and data analysis. In addition to the inquiry audit, two supervisors with extensive academic experience were available for guidance and tutoring throughout the thesis process. (Davies & Dodd 2002, 279-289; Tappen 2011, 160-161)

Confirmability refers to the degree to which the study findings can be traced to data derived from the informants and the research settings, and not to the investigator's biases. In the present study the principle of confirmability was achieved by developing a systemic collection of research materials and documentations and by involving external auditors, who examined the data collection and analysis procedures and evaluated the potential for bias or distortion. (Chilisa 2012, 171)

9.4 Recommendations for Future Studies

The current study suggests that 12-week exercise programme can produce benefits with regard to improvement of some aspects of functional capacity (hand grip strength and walking speed) of the elderly adults, thus contributing to a better quality of life. However, to conclusively confirm these benefits, future investigators need to conduct randomized controlled studies with larger in size and less age-heterogeneous subject samples. Exercise programmes must be planned more thoroughly including loads, doses, duration and type of the training for each particular individual. It would be more beneficial to focus training sessions on exercising tested variables. I would also recommend the future researchers to expand the study area and assess functional capacity of the elderly adults from other municipalities. It would be also interesting to make comparisons between female and male participants.

9.5 Self-Evaluation and Final Words

This thesis is a part of the fitness training project for seniors in the municipality of Nakkila, and the topic for it was chosen based on the project's aim. The idea of determining the difference between functional capacity and exercise training provided me an opportunity to conduct a clinical experiment, the results of which would be useful for the elderly inhabitants of the municipality of Nakkila, and hopefully, would be utilised by the project coordinators for developing future services for the community-dwelling elderly inhabitants.

The overall thesis process, from formulation of the idea to the presentation of the final thesis, took approximately one and a half years. The planning and implementation parts of the thesis went quickly and smoothly as was scheduled, owing to the project coordinators. I felt sufficiently adept with the theoretical knowledge of the topic and was able to select significant and appropriate information related to the choice of the thesis topic. However, due to some unexpected delays, the written part of the thesis and evaluation of the findings took up more time than was prearranged.

The theoretical part of this thesis is based on combinations of health care and physiotherapy text books, scientific journals, articles and other clinical studies. In my opinion, it fulfils the main aspects relevant to the topic. However, in the beginning of the writing process, it turned out to be difficult to remain within the borders of the thesis area. But once I realised what the main goal of the research was, I was able to select only relevant material.

Before conducting the assessment, I ensured that the methods of functional measurements, used in the research, were based on reliable sources, and I was confident in utilising them. Prior to the interviews, the questions were shown to the project coordinators to ensure their relevance to the topic, comprehensibility by the informant's, and their grammatical correctness.

The results of this study start to provide quantitative and qualitative evidence for the need to recognize the vulnerability of community-dwelling elderly adults, and

address the need for exercise training programmes for the elderly home health care users to increase quality of their lives and prolong their independence.

The experience of completing this study was concurrently interesting and challenging. This research enabled me to expand my knowledge and understanding of the thesis area as well as to promote the overall level of professionalism.

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APPENDIX 1

TIMETABLE OF THE THESIS WRITING PROCESS

Number	Period	Action
1	January- February 2011	- Creating and developing of the thesis idea and outline.
2	February 2011	- Preliminary literature search.
3	8th February 2011	- Meeting with the project parties: the gym owner and the physiotherapist, responsible for the training sessions; - Discussing the purpose of the project, thesis aim, participants, data gathering methods, participant's training schedule; - Familiarizing with the training facilities of the gym, dedicated for the project.
4	1st March 2011	- Signing the agreement on the thesis preparation; - Implementation of the preliminary interviews and functional tests.
5	3rd March-19th May 2011	- Training sessions: twice per week on Tuesdays and Thursdays.
6	19th May 2011	- Final data collection (tests and post-interviews).
7	15th of June 2011	- Supervision session with the project physiotherapist to discuss the results and share the opinions about the training process.
8	September 2011-June 2012	- Completing and ending the thesis writing process: literature search, data analysis, and supervision sessions with the thesis tutor.
9	24th August 2012	- Thesis presentation.
10	24th August 2012	- Maturity test.

APPENDIX 2

INFORMED CONSENT OF THE INFORMANT

By signing this consent form I state that:

- I have received the information about the study being conducted by Ekaterina Kosinova of the Satakunta University of Applied Sciences, Pori
- I have had the opportunity to ask questions related to this study and received satisfactory answers to my questions, including any additional details that I wanted
- I agree of my interview session being written down
- I am aware that the information from the interview will be included in the findings and will be kept anonymous
- I know that I am free to withdraw my consent from the study at any time
- I participate in this study of my own free will
- I am informed that whenever I have any comments or concerns resulting from my participation in the study, I could contact the researcher Ekaterina Kosinova

_____

Informant's Name

_____

Informant's Signature

_____

Place and Date

APPENDIX 3

HAASTATTELUSUOSTUMUS

Allekirjoittamalla tämän haastattelusuostumuslomakkeen täten vakuutan että:

- Olen saanut tutkimukseen liittyvän aineiston, jonka tuottajana toimii Ekaterina Kosinova Satakunnan Ammattikorkeakoulusta, Porista
- Minulla on ollut mahdollisuuus kysyä tutkimukseen liittyviä kysymyksiä ja saada riittävästi tietoa kysymyksiini
- Hyväksyn että muistiinpanoja saa tehdä haastattelun aikana
- Olen tietoinen että haastatteluista tulleita tiedot tullaan käyttämään opinnäytetyössä nimettöminä
- Olen tietoinen siitä että voin vetäytyä tutkimuksesta milloin tahansa.
- Osallistun tutkimukseen omasta vapaasta tahdostani
- Olen tietoinen siitä että jos minulle tulee epäilyksiä, kommentteja, kysymyksiä osallistumisestani tutkimukseen, voin ottaa yhteyttä tutkija Ekaterina Kosinovaan

_____

Tutkimukseen osallistujan nimi

_____

Tutkimukseen osallistujen allekirjoitus

_____

Aika ja päivämäärä

APPENDIX 4

PRELIMINARY INTERVIEW QUESTIONS FOR THE STUDY PARTICIPANTS

1. PERSONAL INFORMATION

1.1 Name_____

1.2 Gender ☐ Female ☐ Male

1.3 Age_____

1.4 Year of birth_____

1.5 Height_____cm

1.6 Paino_____kg

1.7 Blood pressure, heart rate_____mm/Hg, beats per minute

2. PRESENT HEALTH CONDITION

2.1 How would you evaluate own health condition on the present moment?

☐ Excellent ☐ Good ☐ Average ☐ Satisfactory ☐ Bad

2.2 Do you have any deseases?

_____

3. LIVING CONDITIONS

3.1 Type of accomodation?

☐ Apartment building, _____ floor

☐ Terraced house

☐ Separate house

☐ Other, what? _____

3.2 Does anyone elde live with you?

☐ I live alone

☐ Spouse

☐ Own children

☐ Other, what? _____

3.3 Did you change your apartment during the last year?

☐ No

☐ Yes, once

☐ Yes, several times

3.4 Why did you change the apartment?

☐ I didn't move

☐ Due to the problems with ambulation

☐ Becaus of health reasons

☐ Due to social problems

☐ For own comfort

☐ Due to financial reasons

☐ Due to the absence of an elevator

☐ Safety issues

☐ Other reasons, what? _____

3.5 How long is the distance from home to the nearest?

Place	< 0,5 km	0,5-1 km	> 1 km
Grocery store			
Pharmacy			
Bank			
Post office			
Health center			
Bus stop			

3.6 Do you have any problems with moving inside home environment?

☐ No

☐ Yes, what causes the problem? _____

_____

4. FUNCTIONAL CAPACITY

4.1 How do you assess own functional capacity?

☐ Excellent ☐ Good ☐ Average ☐ Satisfactory ☐ Bad

4.2 Do you have any difficulties in coping with dailiy activities at home enviroment?

☐ Never ☐ Seldom ☐ Sometimes ☐ Often ☐ Daily

4.3 Do you have any difficulties in coping with dailiy activities outside home enviroment?

☐ Never ☐ Seldom ☐ Sometimes ☐ Often ☐ Daily

4.4 How do you cope with the following activities?

Activity	Well	I have some difficulties	I need help	Fully dependnent
Eating				
Trnasfers to and from bed				
Dressing				
Hygiene				
Ambulation inside				
Ambulation outside				
Walkign stairs				
Cutting nails on feet				
Toileting				
Food preparation				
Laundry				
Light housekeeping (e.g. dishwashing, ironing)				
Heavy housekeeping (e.g. cleaning windows and floors)				
Managing issues with e.g. bank, pharmacy, bank, post office, grocery store)				
Taking medication				
Carrying heavy items, such as 5 kg shopping bag for a distance of 100 m				

4.5 Do you use any supportive devices?

	Yes	No	What?
For moving inside			
For moving outside			
Other supportive devices			

4.6 Do you use any services from outside?

Service	I don't need/ I don't use	I need, but I don't get /use	I use	Times per day	Times per week	Times per month
Home care						
Home health care						
Food service						
Day center/ Day hospital service						
Transportation service						
Sauna service						
Physiotherapy						
Other, what?						

4.7 If you use services, what kind of help do you need from them?

_____

4.8 Who of the following persons help you?

☐ Nobody

☐ Relatives

☐ Neighbours

☐ Friends

☐ Volunteers

☐ Publichealth nurse

☐ Housekeeper

☐ Deaconess

☐ Other, who? _____

5. ACTIVITY LEVEL

5.1 Are you retired?

☐ No ☐ Yes, When did you retire?_____

5.2 How important, do you think is exercise?

☐ I think exercise is unnecessary and useless waste of time

☐ Exercise not that important

☐ I don't know

☐ I think exercise is somewhat importnant (e.g.for the health)

☐ I thinkg exercise is very important

5.3 How much do you walk outside?

☐ I don't walk outside

☐ I walk outside for approximatly _____km/week

5.4 How often do perform fitness exercise? (minimum 10 min/time)

☐ Not at all

☐ Every now and then (few times per year)

☐ 1-2 times per month

☐ Once per week

☐ Twice per week

☐ 3-4 times per week

☐ 5 times per week or more often

APPENDIX 5

ESIHAASTATTELU KYSYMYKSET TUTKIMUKSEEN OSALLISTUJILLE

1. HENKILÖTIEDOT

1.1 Nimi_____

1.2 Sukupuoli ☐ Nainen ☐ Mies

1.3 Ikä_____

1.4 Syntymävuosi_____

1.5 Pituus_____cm

1.6 Paino_____kg

1.7 Verenpaine, pulssi_____mm/Hg

2. NYKYINEN TERVEYDENTILA

2.1 Millainen on tämänhetkinen terveydentilanne omasta mielestänne?

☐ Erittäin hyvä ☐ Melko hyvä ☐ Keskinkertainen ☐ Melko huono ☐ Huono

2.2 Mitä sairauksia Teillä on nykyisin?

_____

3. ASUMINEN

3.1 Asuntomismuoto?

☐ Kerrostalo, _____ kerros

☐ Rivitalo

☐ Omakotitalo

☐ Muu, mikä? _____

3.2 Asuuko asunnossanne teidän lisäksi muita?

☐ Asun yksin

☐ Puolisoni kanssa

☐ Omien lasteni kanssa

☐ Muu, kuka? _____

3.3 Oletteko vaihtanut asuntoa viimeisen vuoden aikana?

☐ Ei

☐ Kyllä, kerran

☐ Kyllä, useita kertoja

3.4 Miksi olette muuttuneet?

☐ En ole muutanut

☐ Liikkumisvaikeuksien vuoksi

☐ Terveydellisistä syistä

☐ Ihmissuhteisiin liittyvistä vuoksi

☐ Oman viihtyvyyden vuoksi

☐ Taloudellisista syistä

☐ Hissin puutumisen vuoksi

☐ Turvattomuuden vuoksi

☐ Muiden syiden vuoksi, minkä? _____

3.5 Miten pitkä matka kotoanne on lähimpään?

Paikka	< 0,5 km	0,5-1 km	> 1 km
Ruokakauppa			
Apteekkiin			
Pankkiin			
Postiin			
Terveyskeskukseen			
Julkisen kulkuneuvon pysäkille			

3.6 Pystyttekö liikkumaan asunnossanne ongelmitta?

☐ Kyllä

☐ En, mikä tuottaa ongelmia? _____

_____

4. TOIMINTAKYKY

4.1 Millaisena pidätte omaa toimintakykyänne?

☐ Erittäin hyvänä ☐ Melko hyvänä ☐ Hyvänä ☐ Huonona ☐ Erittäin huonona

4.2 Onko teillä vaikeuksia selviytyä kotona päivittäisissä toiminnoissa?

☐ Ei lainkaan ☐ Joskus ☐ Melko usein ☐ Usein ☐ Päivittäin

4.3 Onko teillä vaikeuksia selviytyä kodin ulkopuolisissa toiminnoissa?

☐ Ei lainkaan ☐ Joskus ☐ Melko usein ☐ Usein ☐ Päivittäin

4.4 Miten selvätte seuraavista askereista?

Toiminta	Hyvin	Minulla on vaikeuksia	En selviydy ilman apua	En joudu tekemään
Syöminen				
Vuoteeseen ja sieltä posi siirtyminen				
Pukeutuminen				
Peseytyminen				
Sisällä liikkuminen				
Ulkona liikkuminen				
Kulkemaan portaita				
Varpaankynsien leikkaminen				
WC:ssä käyminen				
Ruan valmistaminen				
Vaatteiden peseminen				
Kevyet taloustyöt (esim. tiskaaminen, silittäminen)				
Raskaat taloustyöt (esim. siivous, ikkunan pesu)				
Asioiminen (esim. aptekki, pankki, posti, kauppa)				
Lääkkeiden ottaminen				
Painavia tavaroita kantaminen, esim. 5 kg:n ostoskassia 100 metriä				

4.5 Onko teille käytössänne apuvälineitä?

	Kyllä	Ei	Mitä?
Kotona liikkuessanne			
Ulkona liikkuessanne			
Muita apuvälineitä			

4.6 Onko teillä käytössänne kodin ulkopuolista apua?

Palvelu	En tarvitse/ en käytä	Tarvitse, mutta en saa/ en käytä	Käytän	Kertaa vrk	Kertaa vk	Kertaa kk
Kotipalvelu						
Kotisairaanhoito						
Ateriapalvelu						
Päiväkeskuksen/ päiväsairaalan palvelut						
Kuljetuspalvelu						
Saunapalvelu						
Fysioterapeutti						
Muu, mikä?						

4.7 Jos käytössänne on kodin ulkopuolista apua, millaista apua tarvitsette?

_____

4.8 Ketkä seuraavista henkilöistä auttavat Teitä?

☐ Ei kukaan

☐ Omaiset

☐ Naapurit

☐ Tuttavat

☐ Vapaaehtoistyöntekijät

☐ Teveydenhoitaja

☐ Kodinhoitaja

☐ Diakonissa

☐ Joku muu, kuka? _____

5. AKTIVISUUSTASO

5.1 Oletteko eläkkeellä?

☐ En ☐ Kyllä, Milloin jäitte eläkkeelle?_____

5.2 Miten tärkeäksi koette liikunnan harrastamisen?

☐ Liikunta on mielestäni tarpeetonta ja hyödytöntä ajan hukkaa

☐ Lliikunta ei ole erityisen tärkeää

☐ En osaa sanoa

☐ Pidän liikuntaa jonkin verran tärkeänä (esim. terveyden vuoksi)

☐ Pidän liikuntaa erittäin tarkeänä

5.3 Kuinka paljon kävelette ulkona?

☐ En kävele ulkona

☐ Kävelen ulkona keskimäärin _____km/viikossa

5.4 Kuinka usein harrastatte kuntoliikuntaa? (vähintään 10 min/kerta)

☐ En lainkaan

☐ Silloin tällöin (muutaman kerran vuodessa)

☐ 1-2 kertaa kuukaudessa

☐ Kerran viikossa

☐ Kaksi kertaa viikossa

☐ 3-4 keraa viikossa

☐ 5 keraa viikossa tai useammin

APPENDIX 6

FINAL INTERVIEW QUESTIONS FOR THE STUDY PARTICIPANTS

1. REASONS FOR JOINING THE PROJECT

1.1 Why did you decide to join the project?

_____

1.2 What expectations did you have concerning this project?

_____

2. EFFECTIVENESS OF THE PROJECT

2.1 Do you feel that your physical condition have changed during this project? If yes, how?

_____

2.2 Do you feel that it is easier to perfrom the tasks of daily living nowadays? If yes, how?

_____

3. EVALUATION OF THE PROJECT

3.1 What did you like ahd dislike abouth the project? Would you like to change anything?

_____

3.2 Would you like to continue exercising if the project continues?

_____

3.3 Are you going to continue exercising on your own after the project?

_____

3.4 Would you recommend this project to your friends or neighbours?

_____

3.5 Do you want to add anything?

_____

APPENDIX 7

LOPPUHAASTATTELU KYSYMYKSET TUTKIMUKSEEN OSALLISTUNEILLE

1. SYITÄ LIITTYÄ HANKKEESEEN

1.1 Miksi päätitte liittyä hankkeeseen?

_____

1.2 Mitä odotuksia teillä oli tätä projektia kohtaa?

_____

2. HANKKEEN VAIKUTTAVUUS

2.1 Koetteko että fyysinen kunto muuttunut tämän projektin aikana? Jos kyllä, miten?

_____

2.2 Onko nykyään fyysinen tehtävien suorittaminen helpompaa? Jos kyllä, miten?

_____

3. HANKKEEN ARVIOINTI

3.1 Mitkä asiat miellyttävät ja mitkä eivät? Olisitteko halunnut muuttaa jotain?

_____

3.2 Ajatteletteko jatkaa harjoittelua omatoimisesti projektin jälkeen?

_____

3.3 Ajatteletteko jatkaa harjoittelua jos projekti jatkuu?

_____

3.4 Suositteletteko tämän projektin kavereille, tutuville, tai naapureille?

_____

3.5 Haluatteko lisätä jotain?

_____

APPENDIX 8

DATA FROM FUNCTIONAL MEASUREMENTS OF PRE- AND POST-ASSESSMENTS

Functional measurements	*Participants (age in years): I = Pre-assessment, II = Post-assessment*													
	A (73)		*B (70)*		*C (79)*		*D (70)*		*F (79)*		*G (86)*		*H (86)*	
	I	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*
Isometric Hand Grip test dominant hand (kg)	*33*	*40*	*17*	*20*	*18*	*22*	*34*	*43*	*22*	*28*	*10*	*2*	*20*	*24*
Normal range score (kg)	*≥ 39*		*≥ 39*		*≥ 24*		*≥ 39*		*≥ 24*		*≥ 20*		*≥ 20*	
Isometric Hand Grip test non-dominant hand (kg)	*41*	*39*	*20*	*20*	*20*	*21*	*33*	*32*	*17*	*18*	*10*	*3*	*16*	*18*
Normal range score (kg)	*≥ 36*		*≥ 36*		*≥ 22*		*≥ 36*		*≥ 22*		*≥ 15*		*≥ 15*	
Ten-Meter-Walk test (s)	*7,10*	*5,03*	*12,3*	*10,9*	*5,56*	*5,90*	*8,62*	*7,97*	*16,2*	*17,0*	*14,7*	*14,9*	*10,3*	*9,19*
Normal range score (s)	*≥ 6*		*≥ 6*		*≥ 8*		*≥ 6*		*≥ 8*		*≥ 10*		*≥ 10*	