

**ASSOCIATION OF MUSCLE HEALTH AND QUALITY OF
LIFE IN OLDER ADULTS LIVING IN RURAL COMMUNITY**

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**Association of muscle health and quality of life in older adults living
in rural community**

by

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LIST OF ABBREVIATIONS

Abbreviation	Description
AWGS	Asian Working Group for Sarcopenia
ASMI	Appendicular Skeletal Muscle Mass Index
BMI	Body Mass Index
BIA	Bio-Impedance Analysis
DXA	Dual-energy X-ray Absorptiometric
EWGSOP2	European Working Group on Sarcopenia in Older People
HRQoL	Health Related Quality of Life
MRI	Magnetic Resonance Imaging
OECD	Organisation for Economic Co-operation and Development
QoL	Quality of Life
SPPB	Short Physical Performance Battery
SMMI	Skeletal Muscle Mass Index
SMI	Skeletal Mass Index
SarQoL	Sarcopenia Quality of Life
SarcoPhAge	Sarcopenia and Physical Impairment with advancing Age
WHOQOL-Bref	World Health Organization Quality of Life (Short version)
WHOQOL-100	World Health Organization Quality of Life (Full version)
WHO	World Health Organization

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HUBUNGAN ANTARA KESIHATAN OTOT DAN KUALITI HIDUP DALAM KALANGAN ORANG TUA YANG TINGGAL DI KAWASAN LUAR BANDAR

Abstrak

Kesihatan otot yang lemah yang merangkumi kekuatan otot, jisim otot dan fungsi otot boleh menyebabkan seseorang mempunyai kualiti hidup yang buruk. Tujuan kajian ini adalah untuk mengenal pasti dan menggambarkan hubungan kesihatan otot dan kualiti hidup pada orang dewasa yang lebih tua yang tinggal di kawasan luar bandar. Kami telah rekrut hanya enam orang peserta (dua lelaki dan empat perempuan) dan purata umur kesemua peserta tersebut ialah 65.5 ± 6.3 tahun, dari kawasan luar bandar, Mukim Nibong, Kelantan disebabkan oleh Covid-19 perintah kawalan pergerakan. Kekuatan otot, jisim otot dan kefungsiian oto mereka telah diukur menggunakan kekuatan genggam tangan dynamometer, mesin BIA dan SPPB. Kualiti hidup (QoL) dinilai dengan menggunakan soalselidik ringkas kualiti hidup Pertubuhan Kesihatan Sedunia (WHO) (WHOQoL-BREF) dan kualiti hidup sarcopenia (SarQoL). Kami juga menilai demografi peserta, sejarah kesihatan serta jisim, kekuatan dan fungsi otot. Secara keseluruhan, hanya seorang sahaja yang tidak mengalami sarcopenia, dua orang mengalami sarcopenia dan tiga orang mengalami sarcopenia yang parah. Keputusan menunjukkan bahawa umur mempunyai hubungan yang ketara secara negatif ($p < 0.05$) dengan Domain 2 Psikologikal WHOQOL-BREF, ($r = -0.94$) dan di keseluruhan SarQoL skor ($r = -0.88$) begitu juga dengan D1 (Fizikal dan Kesihatan Mental, $r = -0.89$), D2 (Pergerakan, $r = -0.89$) dan D4 (Kefungsiian, $r = -0.89$). Penyakit darah tinggi juga mempunyai hubungan yang ketara secara negative ($p < 0.05$) dengan Domain 2 ($r = -0.91$) dan Domain 4 (Persekitaran, $r = -0.89$) WHOQOL-BREF dan D1 ($r = -0.89$), D2 ($r = -0.89$), D4 ($r = -0.89$), dan keseluruhan SarQoL skor ($r = -0.88$). Penyakit kencing manis mempunyai hubungan yang ketara dengan D5 (Aktiviti

kehidupan seharian, $r=-0.98$, $p=0.017$). Otot tanpa lemak BIA ($r=-0.84$) dan, lemak ($r=0.84$) mempunyai hubungan yang ketara ($p<0.05$) dengan Domain 3 (Hubungan social, WHOQOL-BREF). Kefungsian otot (SPPB skor) mempunyai hubungan yang ketara ($p<0.05$) dengan keseluruhan SarQoL skor ($r=0.94$) dan D1 ($r=0.89$), D2 ($r=0.89$), D4 ($r=0.89$), dan D6 ($r=0.82$) bahagian SarQoL. Kesimpulannya, skor kualiti kehidupan dalam kalangan warga tua menunjukkan trend penurunan yang ketara daripada peserta yang tidak mengalami sarcopenia sehingga yang mengalami sarcopenia yang parah berdasarkan soalan kaji selidik WHOQOL-BREF dan SarQoL, menunjukkan kualiti hidup yang rendah dengan peningkatan keterukan sarcopenia. Disebabkan kesihatan otot yang lemah boleh memberi kesan lebih daripada kualiti hidup seperti jatuh dan dimasukkan ke hospital, lebih banyak kajian dan perhatian diperlukan di kawasan ini.

ASSOCIATION OF MUSCLE HEALTH AND QUALITY OF LIFE IN OLDER ADULTS LIVING IN RURAL COMMUNITY

Abstract

Poor muscle health that includes muscle strength, muscle mass and muscle function may cause a person to have poor quality of life. The aim of this study is to identify and describe the association of the muscle health and quality of life in older adults living in rural area. We recruited only six participants (two men) , mean age of 65.5 ± 6.3 years, from the rural area, Mukim Nibong, Kelantan due to Covid-19 movement restriction orders. Their muscle strength, muscle mass and muscle function were measured using handgrip dynamometer, bio-electrical impedance analysis (BIA) and Short Physical Performance Battery (SPPB), respectively. Their quality of life (QoL) was assessed by using World Health Organisation (WHO) quality of life brief questionnaire (WHOQol-BREF) and sarcopenia quality of life (SarQoL) questionnaire. We also assessed participants' demographics, health history. Overall, only one participant did not have sarcopenia, two were sarcopenic and three have severe sarcopenia. Results showed that age is significantly negatively correlated ($p < 0.05$) with Domain 2 Psychological (WHOQOL-BREF, $r = -0.94$) and in total SarQoL scores ($r = -0.88$) as well as in D1 (Physical and Mental Health, $r = -0.89$), D2 (Locomotion, $r = -0.89$) and D4 (Functionality, $r = -0.89$). Hypertension is also negatively correlated ($p < 0.05$) with Domain 2 ($r = -0.91$) and Domain 4 (Environment, $r = -0.89$) of WHOQOL-BREF and D1 ($r = -0.89$), D2 ($r = -0.89$), D4 ($r = -0.89$) and overall SarQoL scores ($r = -0.88$). Type 2 diabetes is significantly correlated with D5 (Activities of daily living, $r = -0.98$, $p = 0.017$). BIA lean muscle ($r = -0.84$) and fat ($r = 0.84$) is significantly correlated ($p < 0.05$) with Domain 3 (Social relationship,

WHOQOL-BREF). Muscle function (SPPB scores) are significantly correlated ($p < 0.05$) to overall SarQoL scores ($r = 0.94$) and the D1 ($r = 0.89$), D2 ($r = 0.89$), D4 ($r = 0.89$) and D6 ($r = 0.82$) SarQoL areas. In conclusion, the QoL scores among participants showed an obvious downward trend from the non-sarcopenic, to severe sarcopenic participants based on the WHOQOL-BREF and SarQoL questionnaires, indicating poorer QoL with the increased sarcopenia severity. As poor muscle health can affect more than QoL, such as relate to falls and hospitalization, more research and attention is definitely required in this area.

Chapter 1 Introduction

1.1 Background of the Study

In Malaysia, older adults or elderly citizen are defined as those who are 65 years old and above (Department of Statistics Malaysia, 2020). Globally, the total number of elderly people is anticipated to almost triple from 1980 which is 259 million to 2025 which is 761 million and significantly 72% of this population are located in developing countries (Tobi et al., 2017). Older age population in Malaysia increase each year that leading to an ageing nation and the percentage of population that aged 65 years and over increased from 6.7 percent to 7.0 percent over the same period (Department of Statistics, 2020). According to Department of Statistics (2017), the number of people aged 65 years and over in Malaysia increased steadily since the 1970s, and it is projected the number will triple from 2.0 million today to more than 6.0 million by 2040. Based on this information, we know that older adult population is increasing in Malaysia.

Older age is also characterized by the emergence of several complex health states that tend to occur only later in life and that do not fall into discrete disease categories, and this are commonly called as geriatric syndrome and they are often the consequence of multiple underlying factors and include frailty, urinary incontinence, falls, delirium and pressure ulcers (World Health Organization, 2018). There are many health problems that can occur among older adults that influence their quality of life. One of it is malnutrition. Malnutrition is a serious elderly health issue and it can cause to various health concerns such as muscle weakness and decreased bone mass, which can lead to falls and fractures, a higher risk of hospitalization and increased of death, poor wound healing and others. Lack of nutrition can be due to various factors such as inadequate intake of protein that are needed for muscle health and wound healing

(Molnar et al., 2014). Other than lack of proper nutrition that affects health, ability to be physically active and independent during older adulthood is important too.

Physical activity in later years of life is not only essential to healthy aging and independent functioning, but it also helps prevent chronic diseases, delay and reduce the risks and mortality from non-communicable diseases such as cardiovascular diseases, stroke, diabetes and some type of cancer, maintaining muscle strength and it is also essential for improving quality of life in elderly (Ethisan et al., 2017). Sedentary lifestyle among elderly can lead to cardiovascular disease, cancer, type 2 diabetes, accidental falls, obesity, and others (Rezende et al., 2014). According to Taylor (2014), a recent pooled analysis of large longitudinal studies found that people who engaged in 150 minutes per week of physical activity at moderate intensity had a 31% reduction in mortality compared with those who were less active and the benefit was greatest in those older than 60 years. Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure (Langhammer et al., 2018).

The aging process can lead to loss of muscle strength and muscle mass and known as sarcopenia. Sarcopenia is a common condition in older adults that contributes to functional decline, disability, frailty, falls and this condition can happen because of decline in activity and declines in nutritional intake such as protein (Walston, 2014). Diagnosing sarcopenia requires assessments of muscle mass, muscle strength, physical performance and management of sarcopenia involves a variety approaches such as nutritional and exercise intervention (Cruz-Jentoft et al., 2019). Sarcopenia can happen because of many factors including a loss of motor neurons and muscle fibre, type II fibre atrophy anabolic resistance (i.e. less muscle protein synthesis after protein ingestion, resistance exercise and insulin) and impaired muscle regeneration (Wilkinson et al., 2018). Usually, people who has sarcopenia had significantly lower quality of life

than a normal person (Woo et al., 2018). Older adults who living at urban area have higher quality of life than older adults living at rural area because of the health status at urban area is a lot higher than rural area (You et al., 2019).

Majority of the elderly describe their quality of life positively on the basis of social contacts, dependency, health, material circumstances and social comparisons. The reduced muscle mass and impaired muscle performance may decrease muscle health in older adults and lead to frailty. Frail older adults are particularly vulnerable to external stressors and less able to resist the mental and physical challenge after a destabilizing event and this situation can lead the quality of life to declines because quality of life is an assessment of functional status, physical, mental, social and if any of this term is poorer than normal, it can cause the older adults to have a poorer quality of life than others (Rizzoli et al., 2013). Furthermore, advanced muscle loss in aging is related to the need for health support services, long term care and reduced quality of life (Katula et al., 2008).

1.2 Problem Statement

Muscle strength is the amount of force a person generates or the amount of weight a person can lift and this varies among older adults. Muscle strength relates to how muscle functions in activities of daily living. Aging leads to a progressive decrease of muscle strength, muscle mass and significant decrease in muscle tissue begins around the age of 50 years but becomes more accelerated beyond the 60th year of life (Dechenes, 2004). This study is designed to determine the relationship between muscle health and quality of life in elderly. This study focuses on older adults in a rural setting as the situation, environment and also lifestyle may influence their quality of life.

Findings from this study will inform on health and society strategies to improve quality of life in older adults and provide insight for future research possibilities in this area.

1.3 Research Objective

Main objective:

To determine the relationship between muscle health and the quality of life in older adults living in the rural community.

Specific objectives:

1. To determine the muscle health (strength, mass, and function) in older adults living in a rural community.
2. To identify the relationship between muscle strength on the quality of life in older adults living in a rural community.
3. To identify the relationship between muscle mass on the quality of life in older adults living in a rural community.
4. To identify the relationship between muscle function on the quality of life in older adults living in a rural community.

1.4 Hypotheses

H_{01} : There is no relationship between muscle strength and quality of life in older adults living in rural community.

H_{A1} : There is a significant relationship between muscle strength and quality of life in older adults living in rural community.

H₀₂: There is no relationship between muscle function and quality of life in older adults living in rural community.

H_{A2}: There is a significant relationship muscle function and quality of life in older adults living in rural community.

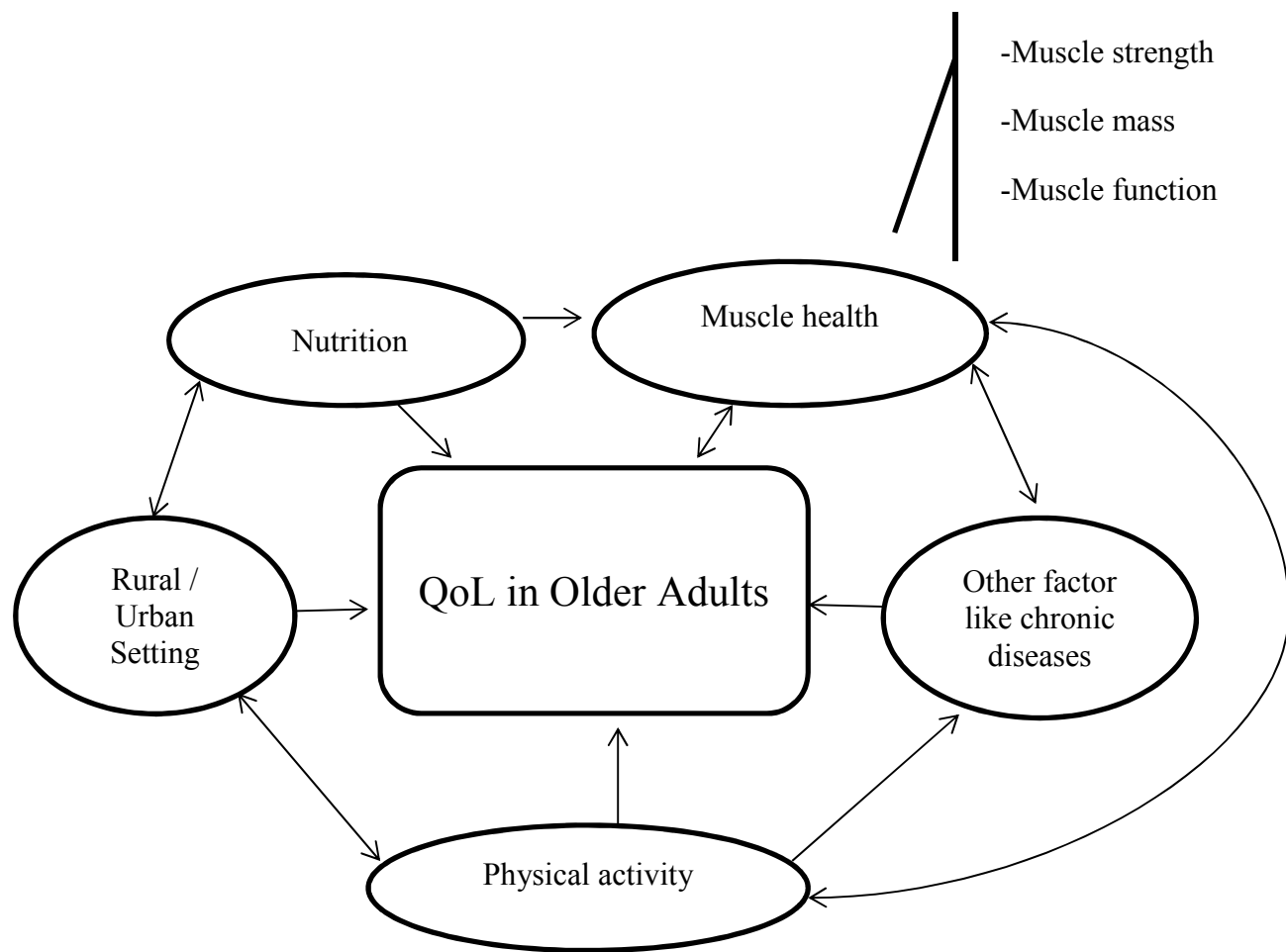
H₀₃: There is no relationship between muscle mass and quality of life in older adults living in rural community.

H_{A3}: There is a significant relationship between muscle mass and quality of life in older adults living in rural community.

1.5 Significance of the Study

The findings from this study will add new information about quality of life related to muscle health in older adults living in a rural community. The Organisation for Economic Co-operation and Development (OECD), uses a threshold of 150 inhabitants per square kilometres to identify rural areas (Plessis et al., 2002). This study also can identify if the older adults have a sarcopenia or not which can affect their quality of life, so that the early treatment can be given. As studies in older adults in rural community settings are few, this will also add to the body of literature of this field. With the knowledge obtained, we will have a better understanding and feed into future research in for older adults in rural communities.

1.6 Conceptual Framework



Chapter 2 Literature Review

2.1 Ageing Population

Older adults are defined as those who are 65 years and above (Orimo et al., 2006). According to the United Nations (2016), in east and north Asia (which include countries with significant ageing populations such as Japan and the Republic of Korea), over a third of the population is expected to be 60 years or older by 2050, whereas in north and central Asia one in four persons will be 60 years or older. According to data from World Population Prospects (2019), by 2050, one in six people in the world will be over age 65 (16%), up from one in 11 in 2019 (9%). By 2050, one in four persons living in Europe and Northern America could be aged 65 or over. In 2018, for the first time in history, persons aged 65 or above outnumbered children under five years of age globally. The number of persons aged 80 years or over is projected to triple, from 143 million in 2019 to 426 million by 2050 (United Nations, 2019).

In Malaysia, older adults are defined as those who are age 65 years and above (Department of Statistics Malaysia, 2020). The population of Malaysia is still relatively young compared to those in the developed countries, but changes in the age structure resulting from fertility decline and increased longevity are contributing towards the ageing of nations, including Malaysia (Beard et al., 2016). Malaysia's total population of older persons in the year 2012 was 8.2% from the total population of the country (2.4 million out of 29.34 million) and by 2020, the population is increased from 6.7 percent to 7.0 percent over the same period (Department of Statistics Malaysia, 2020).

2.2 Health of Older Adults in Urban Versus Rural Areas

The health of older adults in rural area is lower than the older adults that live in urban area (Park et al., 2020). Park and colleagues (2020) studied the factors such as limited dietary intake which is most of the older adults in Korean rural area that mainly rely on foods from farming or home gardening that can lead to limited variety of food especially protein sources, fish, egg and dairy products. Economic disparity also plays a role in availability of food consumption, less available medical services in rural area may hinder the early detection and management of chronic disease among rural participants and the behaviour itself which is been explained that urban senior are more interested in health promoting practices rather than seniors that lived in rural area (Park et al., 2020).

Developed countries usually have a higher percentage of the older population in urban areas than in rural areas (Ding et al., 2020). In a Malaysian, studies have shown that rates of frailty differ greatly in urban versus rural areas. Two studies from urban areas in Malaysia were 5.7% and 8.9% by Sathasivam et al. (2015) and Badrasawi et al. (2017) but rural fragility was 9.4% (Ahmad et al., 2018) when studies were using the same methods and protocols. A study of type 2 diabetes mellitus in a rural Malaysian setting found that physical function was most affected that interfered with their daily activities and working abilities (Rahman et al., 2016). Another study showed that urban women had a higher prevalence of sarcopenia than rural women with 5.7% and 0.7%, respectively (Mazocco et al., 2018). Thus, more studies are needed to understand the muscle health in older adults living in rural communities and the relation to their quality of life.

2.3 Muscle Health in Older Adults

Muscle health is a critical component in the struggle against physical frailty and the efforts to maintain metabolic health until the limits of chronological age. Consensus opinion is to evaluate muscle health in terms of muscle mass, strength and functional capability. Measurements of muscle strength, mass and functionality is important to determine muscle health and sarcopenia (Francis et al., 2017). Muscle mass is a determinant of metabolic homeostasis, physical strength and daily living activities. Higher lean mass equates to higher nutritional reserve and strength whereas lower muscle mass (sarcopenia) is a major contributor to disability and increased mortality (Burini and Maesta, 2012). These three criteria to assess sarcopenia can be measured by using handgrip for strength, body impedance analysis for muscle mass and for muscle function we can use Short Physical Performance Battery (SPPB) (Cruz-Jentoft et al., 2019) Age related decline in skeletal muscle mass and function is associated with health outcomes such as fall risk, fracture, poor mobility and physical disability that could impact older adults' independence and quality of life (Balogun et al., 2019).

The finding of the study has stated that muscle mass, strength, and function will marginally decrease with advancing age (Park et al., 2006). For muscle strength as measured by handgrip test, there was stability in the first decades of adulthood, and decrements in the middle years which is over 45 years and late adulthood and in particular, individuals older than 75 years lose approximately 60% of their muscle strength and 30% of their physical function (Landi et al., 2017). The factors that considered to be the risk to muscle strength are poor physical exercise, poor dietary intake, imbalance between anabolic and catabolic hormones, metabolic disorders and insulin resistance and chronic pro-inflammatory states, gender and age and it also stated that older women are more prone to experiencing accelerated functional decline, and

although they live longer than men they usually have a poorer quality of life (Serra-Prat, et al., 2017).

2.3.1 Muscle strength

Muscle strength refers to the amount of force a muscle can produce with a single maximal effort (Desimone & Grace, 2016). There are many muscle strength tests that can be done to assess the muscle strength which are 1RM Tests, Muscle Fiber RM Test, Isokinetic Strength Tests, Handgrip Strength Test and many others but for older adults, the hand grip strength test is suitable and more common. Thus, hand grip strength is largely consistent as an explainer of concurrent overall strength, upper limb function, bone mineral density, fractures, falls, malnutrition, cognitive impairment, depression, sleep problems, diabetes, multimorbidity and quality of life (Bohannon, 2019). The overall hand-grip strength cut-points for increased likelihood for mobility limitation according to Asian Working Group for Sarcopenia (AWGS) were < 28 kg for men and <18 kg for women (Chen et al., 2020).

2.3.2 Muscle mass

Muscle mass is the size of muscle and it is included in lean body mass. In the muscle mass, there are skeletal muscle, smooth muscle and cardiac muscle however when people talk about muscle mass they usually refer to skeletal muscle. This type of muscle is very important for mobility, balance, strength and it is a sign of physical function (Nunez, 2019), bio-electrical impedance analysis (BIA) and dual-energy X-ray absorptiometry (DXA) are used to assess muscle mass but BIA is more common in research because it is relatively low cost, minimal time required for technical training and is useful and appropriate technique (Sergi et al., 2017). The range of cut-off for appendicular skeletal muscle mass index (ASMI) by BIA was 6.75 – 7.40 kg/m² in men and 5.07 – 5.80 kg/m² in women, whereas cut-offs for skeletal muscle mass index

(SMMI) by BIA validated against MRI ranged between 7.70 and 9.20 kg/m² in men and 5.67 and 7.40 kg/m² in women without considering severity of sarcopenia (Walowski, 2020).

2.3.3 Muscle function

Muscle function is the capacity of a muscle or a group of muscles to generate force to produce, maintain, sustain and modify postures and movements that are the prerequisite to functional activity (American Physical Therapy Association, 2014). SPPB can be used to assess muscle function in older adults because it is a performance-based test of lower extremity function designed for elderly participants and it consists of three parts: balance test, gait test, and chair stand test (Yasuda et al., 2017). Low SPPB scores have been shown to predict poor outcomes and previous research suggests that the SPPB can detect the early stages of frailty (Bergland and Strand, 2019). For gait speed, a single cut-off speed ≤ 0.8 m/s is advised by European Working Group on Sarcopenia in Older People (EWGSOP2) as an indicator of severe sarcopenia and the maximum score for SPPB is 12 points and a score of ≤ 8 points indicates poor muscle performance/function (Cruz-Jentoft et al., 2019).

2.3.4 Factors affecting muscle health

There are certain factors that affecting muscle health. For the first factors, it is nutrition intake by the elderly. Nutrition has been one of the basic needs of every individual living on the earth (Alamgir et al., 2018). A good nutritional status and wherever necessary, supplementation with macronutrients and micronutrients reduce the risk of developing frailty (Artaza-Artabe et al., 2016). Most of the older adults have a low food intake because of the age-related changes in sensory perception, poor oral health and impaired appetite that can lead the person to reduce the meal size, eating frequency and also affect food choice. This means that, without greater consumption of