

ORIGINAL ARTICLE

The Prevalence of Sarcopenia and Its Impact on Quality of Life in Elderly Residing in the Community

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ABSTRACT

Introduction: Sarcopenia is a geriatric syndrome characterized by a reduction in muscle mass, muscle strength and physical performance that may in turn, affect quality of life (QoL) of the elderly. This study aimed to determine the impact of sarcopenia on QoL among elderly residing in the community. **Methods:** This cross-sectional study recruited 201 elderlies (mean age: 68.45 ± 6.30 years). Sarcopenia status was identified using the SARC-F questionnaire that evaluated four aspects (strength, walking assistance, chair rise, stairs climbing, and falls) with 0-2 points for each component. Predictive of sarcopenia or probable sarcopenia (PS) was scored equal to or greater than four and a score that is less than four was categorized as no sarcopenia (NS). The data for QoL were collected using the EQ5D health questionnaire that included five aspects, namely, mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. For comparisons of variables, the independent t-tests and Mann-Whitney U tests were performed for continuous and ordinal variables, respectively. **Results:** The analysis revealed that 20.4% ($n=40$) of the participants were categorized as PS. The majority of the participants with PS were older, women, with over normal value of body mass index (BMI), and have a history of falls. Values in all aspects of QoL were significantly lower ($p<0.05$) in older persons with PS. **Conclusions:** The findings of this study propose that sarcopenia is prevalent among the community-dwelling elderly and their QoL may be impacted by the presence of sarcopenia.

Keywords: Asian Working Group for sarcopenia, Malaysia, Older people, quality of life, Sarcopenia.

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INTRODUCTION

The global aging population of above 65 years is estimated to increase from 443 million to 973 million between 2000 and 2030 (1). Aging is a physiological phenomenon characterized by a reduction in all physical functions that contributes to a decline in quality of life (QoL) (2). The World Health Organization (WHO) described QoL as the acuity of persons' place in life in the perspective of the philosophy and belief culture in which they live and regarding their aims, prospects, principles, and issues (3).

Sarcopenia, one of the most common health issues among older adults, is now regarded as a geriatric syndrome that may lead to various negative health effects including poor QoL and premature mortality

(4). Rosenberg first described sarcopenia in 1989 as a gradual and generalized reduction of muscular properties in terms of strength and mass with increasing age (5). However, the definition of sarcopenia has changed over the years. The European Working Group on Sarcopenia (EWGSOP) was the first organization that described sarcopenia as a decrease in muscular properties which is muscle mass accompanied by a decline in muscle strength or physical performance (6). The Asian Working Group on Sarcopenia (AWGS), on the other hand, described possible sarcopenia as reduced muscular capability in terms of strength with or without somatic performance reduction only (7). This is because the AWGS diagnosed sarcopenia in the Asian people based on special deliberations such as anthropometric and social or way of living variances, has comparatively smaller body measurements, greater adiposity, less mechanized and more active life spans compared to the Western people (7). Besides, the recent recommendation also suggested the use of the SARC-F questionnaire for early screening of sarcopenia (7). The SARC-F questionnaire can rapidly diagnose sarcopenia

based on four components, namely, strength, walking assistance, chair rise, stairs climbing, and falls (8). We believe that these components reflect the basic functional activities in the elderly and may be relevant to begin with primary screening for the elderly residing in the community.

The phenomenon of sarcopenia among the Malaysian population is worth further exploration as a recent study found that the widespread presence of sarcopenia for aged 60 to 70 years and 80 years and over ranged from 5% to 13% and 11% to 50%, respectively (5). This finding may indicate that the Malaysian elderly are at risk of frailty and may have a poor QoL. However, so far there is a lack of studies conducted in Malaysia regarding the impact of sarcopenia on QoL. Previous studies conducted in other countries were inconsistent in terms of the use of QoL measures, definitions of sarcopenia, and the targeted population (9-14). Therefore, this study aimed to determine the impact of Sarcopenia as measured by the SARC-F questionnaire on QoL which was measured using the EQ5D questionnaire (15). The EQ5D is a realistic and convenient instrument for measuring the QoL of the elderly population (16) since it is a standardized indicator for health status that is simple, as well as an appropriate health indicator for diagnostic and therapeutic evaluation (15).

MATERIALS AND METHODS

Study participants

This study was a cross-sectional prospective design that recruited 201 elderlies of both genders of 60 years old and older. A total of eight villages were selected in Selangor Malaysia. The community leader for each village was contacted to arrange for the recruitment and data collection processes. The inclusion criteria for participation were 60 years and over, both men and women, capable of understanding and reading Malay or English, capable of understanding verbal commands, no acute illness such as stroke and Parkinson's disease, and no cognitive impairment based on the Mini Cognitive Test (score >4). The exclusion criteria consisted of the following: critical value of hypertension (systolic blood pressure >180, at the time of the data collection), incapability to comprehend the project protocol, present with a history of cardiac issue, disease of the gastrointestinal tract, and injury over the musculoskeletal region for example: fracture of the bone or sprain that occur <6 months ago, and had recent surgery (<6 months). Informed consents were provided to all participants who were eligible. The study protocol was approved by the Research Ethics Committee of Universiti Teknologi MARA (REC/493/19).

Outcome measures and data collection

Participants' characteristics which included demographic data such as age, gender, ethnicity, and history of fall;

health status such as medical diagnosis and other comorbidities, surgery, vision, and polypharmacy; and cognitive status (Mini-Cog Test) were recorded. The height of participants was measured using a measuring tape that was attached to the wall vertically. The weight and body mass index (BMI) were assessed using a bioelectrical impedance analysis (BIA) tool.

Sarcopenia status

The sarcopenia status of all participants was analyzed using the SARC-F questionnaire (7). SARC-F is a realistic and affordable method that is reliable and easily operated in multiple clinical settings and community healthcare and is reliable and consistent indicator for diagnosing and determining the association of individuals at risk of sarcopenia with adverse effects (6).

The SARC-F questionnaire is a self-reported questionnaire comprising of five items focused on the understanding of the patient's strength limits, walking capacity, chair rise, ascending stairs, and experiences with falls (7). Each component is scored from zero to two points which makes the total score of ten points. An individual is considered as at risk or probable sarcopenia if he/she has a SARC-F score more than or equal to four (7).

Quality of life

The quality of life (QoL) of all participants was evaluated using the European quality of life questionnaire (EQ5D). EuroQoL Group has provided the approval to use the EQ5D questionnaire (Registration ID: 31454). The EuroQoL group developed EQ5D which comprises the EQ Visual Analogue Scale (EQ-VAS) assessment system and the EQ5D descriptive system (15). The descriptive system of EQ5D contains five aspects including individual care, mobility, daily activities, pain or discomfort, and mental abnormalities such as anxiety or depression and each aspect measures five severity levels which are; first level is no problems, second level is slight problems, third level is moderate problems, fourth level is severe problems, and fifth level is extreme problems. The participants were required to specify his/her health status by marking with a cross or a tick in the box in contrast to the most relevant statement based on the severity levels for each of the five dimensions. In terms of a five-digit code, each level is referred to where the first level is coded as '1', second level is coded as '2', third level is coded as '3', fourth level is coded as '4', and fifth level is coded as '5'. The results were recorded in terms of the code, for example, 11111 shows no problems with any of the five dimensions, while 23455 shows slight mobility problems, moderate washing or dressing problems, severe problems with doing usual activities, extreme pain or discomfort, and extremely anxious or depressed. The EQ-VAS is a health scale which is individually rated from zero to 100 where zero suggests 'Worst imaginable health state' while 100 suggests 'Best imaginable health state'. EQ5D has also been utilized in six countries in a wide assortment of

patient's populations, including eight groups of patients with chronic conditions such as cardiovascular illness, lung illness, liver illness, stroke, diabetes, arthritis, depression, and personality disorders; and a student cohort, so it is proposed that EQ5D is a reliable tool to assess QoL (15).

Data Analysis

The collected data were statistically processed and analyzed using the Version 21 of the IBM Statistical Package for Social Sciences (SPSS). The normality of dependent variables was determined using the Kolmogorov-Smirnov (K-S) test. A descriptive analysis was conducted on participants' characteristics and to compare the QoL based on the EQ5D domains according to sarcopenia status based on the SARC-F questionnaire. Mann-Whitney tests and independent t-test were performed on the EQ5D and EQ-VAS, respectively, to determine differences between participants' shells or not respectively to sarcopenia status. The level of statistical significance was set at $p < 0.05$.

RESULT

Table I reports the participants' characteristics according to sarcopenia status. The participants' mean age was 67.73 ± 5.95 years in the no sarcopenia (NS) group while 71.29 ± 6.86 in the probable sarcopenia (PS) group (range: 60 – 90 years). When comparing the characteristics between NS and PS, significant differences were found in age, gender, history of falls,

Table I: Characteristics of participants according to sarcopenia status based on SARC-F questionnaire (N=201) (cont.)

| Characteristics | Sarcopenia status | | P Value |
|--------------------------------------|--------------------------|---------------------------------|----------------------|
| | No Sarcopenia (n=160) | Probable sarco- penia (n=41) | |
| | n (%) Mean ± SD | n (%) Mean ± SD | |
| Comorbidities | | | |
| Yes | 118 (73.8) | 39 (95.1) | 0.003 ^{b**} |
| No | 42 (26.3) | 2 (4.9) | |
| Surgery | | | |
| Yes | 35 (21.9) | 9 (22.0) | 0.992 ^b |
| No | 125 (78.1) | 32 (78.0) | |
| Vision Impairment | | | |
| Yes | 69 (43.1) | 12 (29.3) | 0.107 ^b |
| No | 91 (56.9) | 29 (70.7) | |
| Polypharmacy | | | |
| Yes | 82 (51.3) | 34 (82.9) | 0.001 ^{b**} |
| No | 78 (48.8) | 7 (17.1) | |
| Height (cm) | 160.72 ± 9.45 | 158.29 ± 8.28 | 0.135 ^a |
| Weight (kg) | 68.83 ± 13.53 | 70.07 ± 12.28 | 0.593 ^a |
| Body mass index (kg/m ²) | 26.57 ± 4.36 | 28.23 ± 5.61 | 0.042 ^{a**} |

Values are presented as frequency, n (%) or mean \pm standard deviation (SD)

** : Significant difference; *: Independent t-test; ^b: Chi-Square test

Table I: Characteristics of participants according to sarcopenia status based on SARC-F questionnaire (N=201)

| Characteristics | Sarcopenia status | | P Value |
|-----------------|--------------------------|-------------------------------|----------------------|
| | No Sarcopenia (n=160) | Probable sarcopenia (n=41) | |
| | n (%) Mean ± SD | n (%) Mean ± SD | |
| Age (years) | 67.73 ± 5.95 | 71.29 ± 6.86 | 0.001 ^{a**} |
| Gender | | | |
| Women | 72 (45.0) | 32 (78.0) | 0.001 ^{b**} |
| Men | 88 (55.0) | 9 (22.0) | |
| Ethnicity | | | |
| Malay | 126 (78.8) | 29 (70.7) | 0.140 ^b |
| Chinese | 20 (12.5) | 4 (9.8) | |
| Indian | 14 (8.8) | 8 (19.5) | |
| History of fall | | | |
| Yes | 42 (26.3) | 29 (70.7) | 0.001 ^{b**} |
| No | 118 (73.8) | 12 (29.3) | |

continued

comorbidities, polypharmacy, and BMI (All $p < 0.05$). Based on the SARC-F questionnaire cut-off, about 20.4% (n=41) of the participants were classified as PS. There were significant differences shown between NS and PS based on the SARC-F questionnaire in all dimensions of EQ5D ($p < 0.05$). The mean score for EQ-VAS for NS (74.67 ± 13.47) was higher than the PS (62.39 ± 12.85).

Table II: Quality of Life (QoL) according to Sarcopenia Status based on SARC-F Questionnaire

| QoL variables | No sarcopenia (n=160) | Probable sarcopenia (n=41) | P value |
|---|-----------------------|----------------------------|----------------------------|
| Mobility, n (%) | | | |
| I have no problems in walking about | 117 (73.1) | 3 (7.3) | 0.001^{a**} |
| I have slight problems in walking about | 37 (23.1) | 16 (39.0) | |
| I have moderate problems in walking about | 4 (2.5) | 17 (41.5) | |
| I have severe problems in walking about | 2 (1.3) | 5 (12.2) | |
| I am unable to walk about | 0 (0.0) | 0 (0.0) | |

continued

Table II: Quality of Life (QoL) according to Sarcopenia Status based on SARC-F Questionnaire(cont.)

| QoL variables | No sar- copenia (n=160) | Probable sarcopenia (n=41) | P value |
|--|-------------------------------|----------------------------------|----------------------------|
| Self-care, n (%) | | | |
| I have no problems cleaning or dressing myself | 145 (90.6) | 26 (63.4) | 0.001^{a**} |
| I have slight problems cleaning or dressing myself | 12 (7.5) | 13 (31.7) | |
| I have moderate problems cleaning or dressing myself | 3 (1.9) | 2 (4.9) | |
| I have severe problems cleaning or dressing myself | 0 (0.0) | 0 (0.0) | |
| I am unable to clean or dress myself | 0 (0.0) | 0 (0.0) | |
| Usual activities (e.g. work, study, housework, family or leisure activities), n (%) | | | |
| I have no problems doing my usual activities | 111 (69.4) | 6 (14.6) | 0.001^{a**} |
| I have slight problems doing my usual activities | 42 (26.3) | 29 (70.7) | |
| I have moderate problems doing my usual activities | 5 (3.1) | 6 (14.6) | |
| I have severe problems doing my usual activities | 2 (1.3) | 0 (0.0) | |
| I am unable to do my usual activities | 0 (0.0) | 0 (0.0) | |
| Pain/discomfort, n (%) | | | |
| I have no pain or discomfort | 68 (42.5) | 2 (4.9) | 0.001^{a**} |
| I have slight pain or discomfort | 74 (46.3) | 12 (29.3) | |
| I have moderate pain or discomfort | 15 (9.4) | 21 (51.2) | |
| I have severe pain or discomfort | 3 (1.9) | 6 (14.6) | |
| I have extreme pain or discomfort | 0 (0.0) | 0 (0.0) | |
| Anxiety/depression, n (%) | | | |
| I am not anxious or depressed | 119 (74.4) | 14 (34.1) | 0.001^{a**} |
| I am slightly anxious or depressed | 34 (21.3) | 23 (56.1) | |
| I am moderately anxious or depressed | 4 (2.5) | 4 (9.8) | |
| I am severely anxious or depressed | 2 (1.3) | 0 (0.0) | |
| I am extremely anxious or depressed | 1 (0.6) | 0 (0.0) | |
| EQ-VAS (mean (SD)) | 74.67 ± 13.47 | 62.39 ± 12.85 | 0.001^{b**} |

Values are presented as frequency, n (%) or mean ± standard deviation (SD)

^a: Significant difference; *: Mann-Whitney tests; ^b: Independent t-tests

The QoL dimensions are presented in Table II.

DISCUSSION

This study found that about 20.4% of the total

participants were categorized as PS or at risk of sarcopenia. Participants with PS were older, the majority were women, have a higher BMI, and have a history of falls when compared to those without sarcopenia. This finding is supported by a previous study where the prevalence of sarcopenia increases with age (5-13% in elderly aged 60 to 70 years and 11-50% in elderly aged 80 years) (5). In terms of gender, the finding is consistent with another study that found the widespread of sarcopenia in women was higher (48.7%) than in men (19.6%) (17). Sarcopenic elderly were also found to have a greater body weight, lower muscle mass, and greater fat mass than non-sarcopenic elderly considering their nutrition intake was the same (18). Reduced muscle mass and muscle strength also cause poor balance and mobility and this will further lead to an increase in the risk of fall in the elderly (19). This is because the loss of lean mass due to diminished type II muscle fibers as part of normal aging changes will affect protein synthesis and cause a reduction in muscle strength and decreased motor neurons which in turn affect balance, hence increasing the risk of falling (20).

In general, the findings of this current study suggested that the measure of QoL using the EQ-5D for the elderly can differentiate sarcopenia status based on the SARC-F questionnaire. Sarcopenia is a serious clinical problem that threatens independence and QoL in the elderly because it can cause a decrease in physical functioning, strength, and health status where it can lead to impaired mobility, disability, and increased risk of falls or mortality (21). Other disorders such as cardiovascular and respiratory diseases, breast cancer, type II diabetes mellitus, glycaemic and metabolic regulation changes, decreased basal metabolism, osteoporosis, osteopenia, obesity, bone fragility, falls, diminished mobility, and decreased functional ability are also associated with sarcopenia where these factors may influence functional dependency and increases risk of hospitalization, institutionalization, cost of health care, and ultimately poor QoL (10). A previous study also revealed that elderly aged 65 years with sarcopenia had lower QoL compared to those without sarcopenia, however, this study used the self-administered SarQoL, and sarcopenia was diagnosed based on muscle mass using DXA, handgrip strength using a dynamometer (hand-held), and gait speed using 4MWT (9).

A substantial difference in QoL between non-sarcopenic and probable sarcopenic participants based on the SARC-F questionnaire was found in the current research. The EQ-5D-5L questionnaire also measures anxiety and depression dimensions, and the current finding showed a more negative impact on participants with probable sarcopenia. Depression and sarcopenia are among the common geriatric syndromes in which depression can be triggered by some factors such as physical illness, malnutrition, cognitive decline, falls, and polypharmacy (22). Besides, a brain-derived neurotrophic factor is

produced in skeletal muscle and myogenic progenitors where it may have specific roles in the neuromuscular systems that could lead to sarcopenia-associated depression, anxiety, and cognitive losses (23). Sarcopenia, on the other hand, can cause disability in basic activities of daily living (ADL) and instrumental activities of daily living (IADL) (24). These disabilities may impair QoL, and increase morbidity and mortality among the elderly (24). A similar finding has been shown in a previous study where sarcopenia was diagnosed using the SARC-F questionnaire while depression was determined using the scale for depression by the Centre for Epidemiologic Studies (CES-D 7) tool, and that sarcopenia was correlated with depressive symptoms (25). The correlation of obesity with psychological health (suicidal ideation and perceived stress) and poor QoL has also been documented in a study among Korean adults (26). Accumulated abdominal fat and reduced muscle fibers have led to metabolic illnesses and low inflammation rates, and can also result in higher levels of pro-inflammatory cytokines and fat disruption, contributing to muscle weakening and insulin obstruction (27). Older adults appear to have inflammation and reluctance towards insulin because of the reduction in type II muscle fibers (13). It has also been suggested that inflammation-induced by obesity or sarcopenia may lead to disruption of the hypothalamic-pituitary-adrenal (HPA) axis, meanwhile, increased insulin resistance can induce alterations in the brain, hence, these metabolic disorders will further exacerbate psychological health and QoL (13).

A few limitations were noted in this current study, Firstly, there were lack of participants from other ethnics namely the Chinese and Indians as the majority of the sample recruited were among the Malays. Another limitation is that the utilization of the SARC-F questionnaire was merely the perception of the participants with regards to their physical wellbeing. Lastly, as some participants had a history of falls, they may have developed fear of fall (FoF) which was not measured in this study that may also influence QoL. A previous study has suggested that fear of fall is an independent predictor of QoL, and where the association between FoF and QoL is more important than age and gender (28). Future research should also broaden the use of more quantitative indicators such as muscular mass, muscular strength, and somatic performance evaluation as the criterion for the diagnosis of sarcopenia, as proposed by the AWGS (7), but this require a large sample size.

CONCLUSIONS

In conclusion, the prevalence of sarcopenia as measured by the SARC-F questionnaire is considerably high among the community-dwelling elderly. This research also shows that the existence of sarcopenia has a detrimental impact on the QoL components as evaluated by the EQ5D. thus, we propose the utilization

of the SARC-F questionnaire as a realistic and quick evaluation to identify sarcopenia among older people in the community.

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REFERENCES

1. Gupta A, Mishra S. Sarcopenia and the syndrome of frailty. *The Egyptian Journal of Internal Medicine*. 2016;28(4):133.
2. Musumeci G. Sarcopenia and Exercise "The State of the Art". *Journal of Functional Morphology and Kinesiology*. 2017;2(4):40.
3. WHOQOL - Measuring Quality of Life The World Health Organization [Internet]. Who.int. 2020 [cited 5 December 2020]. Available from: <https://www.who.int/toolkits/whoqol>
4. Giglio J, Kamimura M, Lamarca F, Rodrigues J, Santin F, Avesani C. Association of Sarcopenia With Nutritional Parameters, Quality of Life, Hospitalization, and Mortality Rates of Elderly Patients on Hemodialysis. *Journal of Renal Nutrition*. 2018;28(3):197-207.
5. Rosli H, Shahar S, Badrasawi M, Singh D, Mohamed SN. Identification of Older Adults with Sarcopenia: Comparison of Two Methods. *Jurnal Sains Kesihatan Malaysia*. 2017;15(02):103-108.
6. Cruz-Jentoft A, Bahat G, Bauer J, Boirie Y, Bruyere O, Cederholm T et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age and Ageing*. 2019;48(1):16-31.
7. Chen L, Woo J, Assantachai P, Auyeung T, Chou M, Iijima K et al. Asian Working Group for Sarcopenia: 2019 Consensus Update on Sarcopenia Diagnosis and Treatment. *Journal of the American Medical Directors Association*. 2020;21(3):300-307.e2.
8. Malmstrom T, Miller D, Simonsick E, Ferrucci L, Morley J. SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes. *Journal of Cachexia, Sarcopenia and Muscle*. 2016;7(1):28-36.
9. Beaudart C, Locquet M, Reginster J, Delandsheere L, Petermans J, Bruyere O. Quality of life in sarcopenia measured with the SarQoL®: impact of the use of different diagnosis definitions. *Aging Clinical and Experimental Research*. 2018;30(4):307-313.
10. Sinesio Silva Neto L, Gomes de Oliveira Karnikowski M, Barbosa Osyrio N, Barbosa Mendes M, Galato D, Barbaresco Gomide L et al. Association between sarcopenia and quality of life in quilombola elderly in Brazil. *International Journal of General Medicine*. 2016;:89.
11. de Oliveira L, Abreu G, Lima L, Aredes M,

- Wiegert E. Quality of life and its relation with nutritional status in patients with incurable cancer in palliative care. *Supportive Care in Cancer*. 2020;28(10):4971-4978.
12. Sun D, Lee H, Yim H, Won H, Ko Y. The impact of sarcopenia on health-related quality of life in elderly people: Korean National Health and Nutrition Examination Survey. *The Korean Journal of Internal Medicine*. 2019;34(4):877-884.
13. Cho Y, Shin S, Shin M. Sarcopenic obesity is associated with lower indicators of psychological health and quality of life in Koreans. *Nutrition Research*. 2015;35(5):384-392.
14. Hong S. Body composition and its association with health outcomes among elderly South Koreans. *Pacific Science Review*. 2014;16(2):110-116.
15. Luo N, Gandhi M, Ang M, Janssen B. QL3 - EQ-5D-5L is more responsive than EQ-5D-3L to treatment benefit of cataract surgery. *Value in Health*. 2018;21:S13.
16. Halaweh H, Willen C, Grimby-Ekman A, Svantesson U. Physical Activity and Health-Related Quality of Life Among Community Dwelling Elderly. *Journal of Clinical Medicine Research*. 2015;7(11):845-852.
17. Kamiya K, Hamazaki N, Matsuzawa R, Nozaki K, Tanaka S, Ichinosawa Y et al. Sarcopenia: prevalence and prognostic implications in elderly patients with cardiovascular disease. *JCSM Clinical Reports*. 2017;2(2).
18. Verlaan S, Aspray T, Bauer J, Cederholm T, Hemsworth J, Hill T et al. Nutritional status, body composition, and quality of life in community-dwelling sarcopenic and non-sarcopenic older adults: A case-control study. *Clinical Nutrition*. 2017;36(1):267-274.
19. Gadelha A, Neri S, Oliveira R, Bottaro M, David A, Vainshelboim B et al. Severity of sarcopenia is associated with postural balance and risk of falls in community-dwelling older women. *Experimental Aging Research*. 2018;44(3):258-269.
20. Pasco J, Sui S, Tembo M, Holloway Kew K, G Rufus P, Kotowicz M. Sarcopenic Obesity and Falls in the Elderly. *Journal of Gerontology & Geriatric Research*. 2018;07(02).
21. Turżańska K, Drelich M, Posturzyńska A. Protein and Physical Activity in Prevention and Treatment of Sarcopenia. *Wiadomości Lekarskie*. 2019;72(9):1660-1666.
22. Patino-Hernandez D, David-Pardo D, Borda M, Pírez-Zepeda M, Cano-Gutiérrez C. Association of Fatigue With Sarcopenia and its Elements: A Secondary Analysis of SABE-Bogotá. *Gerontology and Geriatric Medicine*. 2017;3:233372141770373.
23. Hodinka L. Sarcopenia, Frailty and Dismobility. *Biomedical Journal of Scientific & Technical Research*. 2018;7(2).
24. Kilavuz A, Meseri R, Savas S, Simsek H, Sahin S, Bicakli D et al. Association of sarcopenia with depressive symptoms and functional status among ambulatory community-dwelling elderly. *Archives of Gerontology and Geriatrics*. 2018;76:196-201.
25. Martinez Ruiz A, Roa Rojas P, Carrasco O. Sarcopenia, But Not Sarcopenic Obesity, is Associated with Clinically Significant Depressive Symptoms in Older Mexican Adults. *Clinical Psychiatry*. 2018;04(02).
26. Bruyère O, Beaudart C, Ethgen O, Reginster J, Locquet M. The health economics burden of sarcopenia: a systematic review. *Maturitas*. 2019;119:61-69.
27. Park S, Kwon E, Kwon K. Molecular mechanisms and therapeutic interventions in sarcopenia. *Osteoporosis and Sarcopenia*. 2017;3(3):117-122.
28. Schoene D, Heller C, Aung YN, Sieber CC, Kemmler W, Freiburger E. A systematic review on the influence of fear of falling on quality of life in older people: Is there a role for falls? *Clin Interv Aging*. 2019;14:701-19.