

# AN ANALYSIS OF RESISTANCE TRAINING MODEL REQUIREMENTS PSYCHOLOGICAL BASED IN IMPROVING PHYSICAL FITNESS AND REDUCING FALL RISK FOR THE ELDERLY

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## Abstract

Resistance training is a type of physical activity that uses external resistance to make muscles contract dynamically and statically, which the elderly greatly need. The purpose of this study was to discover how much psychological-based resistance training for the elderly is needed to improve fitness and reduce the risk of falling in the elderly.

Method: This is a descriptive study, and the instrument used is a questionnaire with a psychological-based resistance training guidebook for the elderly, with 58 elderly participating. The calculation of percentage statistical data was employed in data analysis. The research results show that resistance training improves physical fitness for the elderly psychologically based on acceptance and attractiveness of 74.14% in Good qualifications, appropriateness of 81.03% in Very Good qualifications, and implementability of 67.24% in Good qualifications. It can be inferred that (1) psychology-based resistance training in the elderly can increase physical fitness and lower the chance of falling, and, (2) The researchers' psychology-based resistance training exercise model for the elderly is acceptable, attractive, appropriate, beneficial, and implementable by the elderly.

**Keywords:** Resistance Training, Physical Fitness, Psychological, Elderly.

## I. INTRODUCTION

The elderly phase is distinguished by decreasing body functions, such as a decrease in physical fitness, which includes a reduction in cardiovascular endurance, strength, balance, and body flexibility, resulting in decreased independence in everyday life (Eckstrom et al., 2020). Muscle strength and endurance

gradually decline with aging. Muscle morphological changes will result in changes in muscular function, such as decreased muscle strength, elasticity and flexibility, reaction time and relaxation speed, and other functional performance. Reduced muscular function and strength can lead to a loss of body balance, slightly restricted movement/sitting/standing, an increased chance of falling, and changes in

posture (Gao et al., 2019). Various changes linked with aging can influence the occurrence of falls in the elderly, particularly when these changes decrease functional abilities and interfere with sensory or gait and balance instability (Porcari et al., 2015). As a result, many mental aspects, such as self-confidence, commitment, determination, perseverance, discipline, responsibility, motivation, power to concentrate, relaxation, and stress management, must be provided to the elderly.

The participation of the elderly in everyday physical activity or organized resistance training programs is strongly encouraged and has numerous advantages ((Villareal et al., 2017). A sequence of weight training processes can improve the elderly's walking posture, balance, general physical functional capacity, and bone health. Strength training is an excellent way to direct energy in fraternity and friendship for healthy union, intimate and enjoyable situations. Cognitive impairment is a frequent issue among the elderly (Eckstrom et al., 2020). Weight training is one preventive measure that can be taken, as it is expected to prevent cognitive decline in the elderly by increasing physical activity in the form of weight training. The psychological aspect that is more dominantly developed is a realistic attitude towards aging physical and psychological changes, self-acceptance and opportunities to build self-confidence again, participation in doing activities that are healthier, fun, and meaningful, and acceptance by family and society.

Reduced cognitive function is associated with increased age. Increased limitations in the elderly occur between the ages of 50 and 65 (WHO, 2016). The preventive step that can be chosen is to do physical activity because it is proven to be able to slow down aging as you get older. Awareness of the relationship between physical activity and health, interaction with professionals in the health sector, expectations of cultural and social conditions, and the need for vacant land to carry out physical activity are the main obstacles experienced by the elderly. As a result, the elderly require the assistance of others around them to increase participation in

physical activity in the elderly that can be accepted and accessed easily (Ige-Elegbede et al., 2019). Exercise, often known as physical activity, is an important component of healthy aging since it helps to reduce falls, pain, sarcopenia, osteoporosis, and cognitive impairment. Because many elderly do not meet the required amount of exercise per week, efforts must be made to establish a consistent exercise routine that includes cardiovascular exercise, strength, balance, and flexibility (Eckstrom et al., 2020). Many research has been conducted to determine whether or not the elderly who participate in fitness programs will help their bodies as they age (Kuo, 2019).

In Indonesia, the elderly are divided into four age groups: Pralansia (45-59 years), Young Elderly (60-69 years), Middle Elderly (70-79 years), and Old Elderly (80+ years) (BPS, 2019). More specifically, the elderly are classified as individuals who are over 60 years old, with statistics showing that 6 out of 10 elderly falls into the category of young elderly. A research in West Java, for example, included 58 elderly in nursing facilities, with an equal number of elderly men and women. Participants' most common degree of education was Elementary School (41.4%), followed by no education (37.9%). The majority of individuals (77.6%) engaged in moderate physical activity, whereas just 15.5% engaged in low physical activity (Purnama & Suhada, 2019). A study conducted in the Bantul, Yogyakarta, studied the relationship between the elderly's physical activity and the quality of life of elderly in the Integrated Healthcare Center with 123 elderly research subjects, revealing that the majority of the elderly have good physical and mental health qualities (Dewi, 2018).

Furthermore, when compared to other professions, farming provides a high quality of life (Medawati et al., 2020). The two case studies in West Java and Yogyakarta show that the elderly's active participation in physical exercise is a crucial element in enhancing their quality of life. The elderly will go through several physical changes as they reach old age. The following are some of the factors that the elderly face that have a significant impact on

their mental health: decreased physical condition, decreased sexual function and potential, changes in psychosocial aspects, changes related to work, changes in social roles in society, and decreased physical conditions. Other physical changes that occur in an elderly include the body's skin becoming thinner, dryer, and less elastic; Hair loss causes it to turn white, dry, and dull; The number of muscles is reduced, as is their size, overall volume, and their function; The heart muscles degenerate, the heart shrinks, and the ability to pump blood is decreased; The blood vessels stiffen, the mucous membranes and vibrating hairs of the respiratory tract degenerate, and the lung bubbles become less elastic; There is bone loss (osteoporosis), and the surface of the cartilage becomes rough as a result of joint degeneration; The number of nephrons (functional units in the kidneys in charge of cleansing the blood) decreases as the degeneration process continues; as a result, the ability to remove metabolic waste through urine reduces as well. The aging process is regarded as a physiological occurrence that all living things must go through.

The elderly are reported to be in crisis if they are dependent on others (need the services of others) and isolate themselves or withdraw from social activities for a number of reasons, such as retirement, a fairly severe and long sickness, the death of a spouse, and so on. The aging process begins when a person reaches maturity at the age of 30.

The following are some of the health-related issues that the elderly face: (1) Physical Condition Decrease; (2) Sexual Function and Potential Decrease; (3) Changes in Psychosocial Aspects; (4) Work-Related Changes; (5) Changes in Social Roles in Society; and (6) Physical Condition Decrease. People often begin to endure many pathological physical conditions as they age, such as decreased energy, energy drops, wrinkled skin, teeth falling out, brittle bones, and so on. In general, the physical condition of a person who has reached old age has worsened significantly, hence there must be an emphasis or concentration on reducing aging in the elderly by physical activity or exercise.

It is possible for active elderly to create a routine of participation in a sports club. There are various sports groups that use trainers to direct and supervise the activity, but many active elderly prefer to exercise alone since they believe they can still execute any movement. Elderly who understand the type of exercise can even participate in activities like HIIT (High-Intensity Interval Training). Studies show that there is still a significant increase in the ability to breathe maximal oxygen for the elderly who participate in HIIT training (Mekari et al., 2020). Although it is necessary to consider the conditions for which elderly may participate in these training activities. The elderly's habit of doing regular exercise with a long-term intervention also aids in improving VO<sub>2</sub>max (Villareal et al., 2017). According to Herrod (2021) in the end, a high participation of the elderly in long-term physical exercise programs can: (1) improve cardiovascular and neurological control, (2) reduce the risk of dementia, and (3) increase the cost-effectiveness of the use of health resources as a result of decreased need for pharmacological therapy.

## 2. METHOD

A quantitative descriptive research design is used in this study (Nassaji, 2015; Ostrov & Hart, 2012; Paquot & Plonsky, 2017). This research is one of the stages in developing a psychological-based resistance training development model for the elderly according to the Borg & Gall (1984) development model at the large group test stage.

This study included 58 elderly aged 60-70 years and older who were in good health and were not injured or sick. The elderly are willing to participate in this study activity voluntarily, without any pressure from any party.

The questionnaire was used in combination with the Draft Resistance Training Guide Model to improve physical fitness and reduce the risk of falling in the elderly. The number of questions is 34, with a validity value of 0.651 using the Pearson correlation, and a reliability value of 0.863 using the Cronbach's Alpha

reliability test. This instrument includes three indicators: acceptance and attractiveness, appropriateness, and implementation.

This study's data analysis is descriptive quantitative in nature, with percentages as the primary unit of measurement. This study instrument employs a questionnaire with a rating scale of 1 to 5 and descriptors of (5) absolutely appropriate, (4) Appropriate, (3) Slightly appropriate, (2) Inappropriate, (1) Absolutely inappropriate, which then the data will be analyzed using the formula calculation as follows:

$$P = \frac{f}{N} \times 100\%$$

Description:

P: Percentage

f: Searched frequency for the percentage

N: Number of Case

The results of the data analysis are then interpreted and concluded based on the classification criteria for the assessment of product quality in the form of this book. The percentage of criteria is presented in the table below:

Table 1. *Criteria for Achievement Level*

Tingkat Pencapaian	Qualification	Description
81 – 100 %	Excellent	Very practicable, no need for revision
61 – 80 %	Good	Eligible, no need for revision
41 – 60 %	Fair	Fairly good, revision required
21 – 40 %	Poor	Uneligible, revision required
< 20 %	Very Poor	Very inappropriate, revision required

### 3. RESULTS

The purpose of the main research and development field test is to determine whether the product of a psychologically based resistance training model for the elderly in its development meets its performance goals. Furthermore, the information that must be gathered during the field test must be considered. Products that have been revised and refined based on small group trial results are now in the large group testing stage. Large group trials are similar to small group trials, however the number of samples in large group trials is greater. Borg and Gall (1984) said in point 6 of the development research processes that field trials (main field testing), conducted a larger trial comprising 58 persons on four older groups or associations (test subjects). Several focus questions, including the following, must be used as benchmarks in field tests:

- 1) Acceptance & attractiveness, including aspects such as: writing and language of the guidebook, conformity of the book's contents related to language guidelines, written grammar guidelines, ease of movement just by reading manuals, especially for the elderly, accuracy of movement guides with pictures.
- 2) Appropriateness; such as whether the results of the psychological-based resistance training manual design can be used in a variety of environments, such as at home and done independently, or in groups and in pairs, appropriateness includes aspects of: manual display, writing in a sequence of movements, pictures, and exercises, layout location of the manual, composition, material quality, image quality, the usefulness of the contents of the manual, and suitability of images with the manual
- 3) Implementability, including aspects such as the usefulness and function of the guide book model, the presentation of illustrations, which leads to understanding the concept to be implemented, the guide book provides a sense of pleasure when reading it, and it is easy to want to try.

The purpose of this study was to determine the initial assessment when media (books and

videos) were employed for the elderly. This section will provide an overview of the data

from large group studies, which are provided as follows:

Table 2. *Descriptive Statistics Calculation Results*

Indicator	Answer Point					Total
	5	4	3	2	1	
Acceptance & attractiveness	74,14 %	24,14 %	1,72 %	0,00 %	0,00 %	100%
Appropriateness	81,03 %	18,97 %	0,00 %	0,00 %	0,00 %	100%
Implementability	67,24 %	31,03 %	1,72 %	0,00 %	0,00 %	100%

a) Acceptance & attractiveness

The results of the large group test on the acceptance & attractiveness indicators of the guidebook showed that 43 people (74.14%) stated very clear, very suitable, very easy to understand, 14 people (24.14%) stated clear, appropriate, easy to understand, while 1 other person (1.72%) stated it was quite clear, quite appropriate, and quite easy to understand.

The conclusion and decision about the quality of resistance training guide products in improving physical fitness for the elderly psychologically based on acceptance and attractiveness (acceptance & attractiveness) of 74.1% in Good qualification, implying that the psychological-based weight training model guide book for the elderly. Eligible and there is no need for revision.

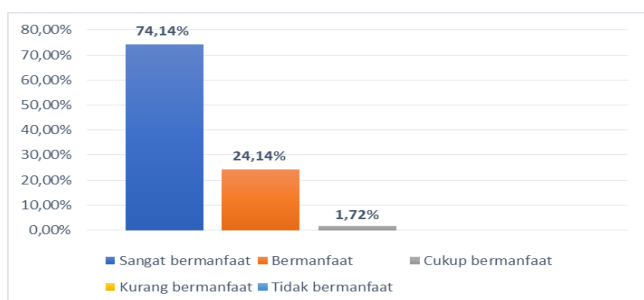


Figure 1. *Large group test results on acceptance & attractiveness*

b) Appropriateness

According to the findings of a large group test on the appropriateness and benefit indicators (appropriateness) with the Elderly, 47 people (81.03%) claimed Very interesting, very appropriate, and very feasible, while 11 other people (18.9%) stated interesting, appropriate, and feasible. Giving conclusions and making decisions about the quality of resistance training guide products in improving physical

fitness for the elderly psychologically, the results are 81.03% with Very Good qualifications, indicating that the psychological-based resistance training model guidebook for the elderly is Very eligible and does not require revision.

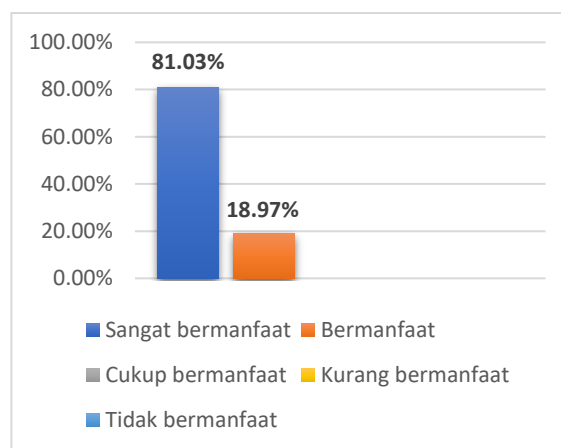


Figure 2 *Large group test results on appropriateness and usefulness (appropriateness)*

c) Implementability

According to the results of the large group test on the Implementability indicator, 39 people (67.24%) said it was very easy to do, very motivating, very feasible, and very useful, 18 people (31.03%) said it was easy to do, motivating, useful, and feasible, and 1 person (1.72%) said it was quite easy to do, motivating enough, quite useful, and quite feasible. Giving conclusions and making decisions about the quality of resistance training guide products in improving physical fitness for the elderly based on psychological aspects of implementation (Implementability) of 67.24% in Good qualification, which means a psychological-based resistance training model guide book for

the elderly is eligible and does not need to be revised.

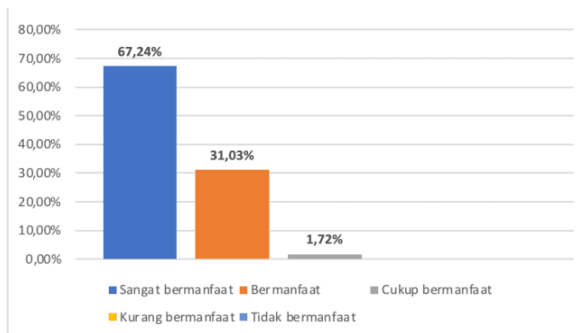


Figure 2. Large group test results on Implementability

#### 4. DISCUSSION

Decreased cognitive function associated with increasing age. Increased limitations in the elderly occur between the ages of 50 and 65 (WHO, 2016). Physical activity is a preventive measure that can be taken because it has been shown to reduce the aging process (Ige-Elegbede et al., 2019). Exercise, often known as physical activity, is an important component of healthy aging since it helps to reduce falls, pain, sarcopenia, osteoporosis, and cognitive impairment. Because many elderly do not meet the required amount of exercise per week, efforts must be made to establish a consistent exercise routine that includes cardiovascular exercise, strength, balance, and flexibility (Eckstrom et al., 2020). Many research have been conducted to determine whether or not the elderly who engage in fitness programs will help their bodies as they age (Kuo, 2019).

Suggestions from responders also play a role in the development and improvement of the product. Testing on a larger sample to learn about the effectiveness of product development. With the aim of demonstrating that the product is suitable for usage in a larger sample where the sample is taken. Product revisions or improvements are based on empirical findings in the field, including findings from the evaluation of results, evaluation of processes and results from developer or researcher observations, and input from respondents.

According to the findings of research, any type of exercise might be healthy for elderly. The facts suggest that long-term exercise that includes a combination of weight training, balance training, and functional training is extremely beneficial to elderly (Seco et al., 2013). Combination exercise habits should be adopted from adolescence, between the ages of 45 and 59 (Badan Pusat Statistik, 2019), as this will be related to the consistency of healthy living behaviors that may be implemented throughout life. First, start with flexibility exercises. We all know that stretching should be done as soon as possible after waking up and again before going to bed for people of all ages (Kenney et al., 2015). However, many people are unaware of the benefits of practicing light exercises, which may be done anywhere, such as on the bed when they first wake up or before going to bed. The principle of flexibility training has remained unchanged since its inception. One common goal of flexibility training is to increase joint space (Bompa & Haff, 2009). Falling easily becomes the most basic hurdle experienced in daily activities for the old and the elderly, especially if you are still making the movement up and down stairs, as science advances and numerous research are undertaken.

Second, is strength training. Weight training performed by the elderly is very beneficial in maintaining muscle mass (Granic et al., 2019) and muscle strength (Fisher et al., 2014; Miller et al., 2021). The purpose of strength training must pay attention to the specifics of choosing which muscles to focus on during exercise (Ribeiro et al., 2020). Strength training recommendations for the elderly are still carried out twice a week, in addition to aerobic exercise three times a week (World Health Organization, 2020). Strength training can minimize the risk of falling in the elderly, one simple form is by walking. Walking has been found to minimize the chance of falling and to strengthen the lower body muscles (Gao et al., 2019). Elderly who are very physically active will tolerate high-intensity weight training once or twice a week without losing the sense of excitement for the elderly who are used to going to the gym (D.L. et al., 2019). The third

form of exercise is balance. Balance training as well as strength training helps to minimize the risk of falling (Cress et al., 2004; Eckstrom et al., 2020; Seco et al., 2013). Balance and strength have an important role for the elderly above other biomotor training goals (Porcari et al., 2015). Without these two things, the elderly have inadequacies or trouble doing essential everyday activities. Independence is lost, and self-confidence also decreases (Eckstrom et al., 2020). As a solution, regular exercise should be done to help the nervous system work in the elderly to stay awake, for example, to streamline movement and reaction time. (Jehu et al., 2017; Lin et al., 2019).

## 5. CONCLUSION

According to the study's findings, (1) psychology-based resistance training in the elderly can improve physical fitness and reduce the risk of falling, and (2) the researchers' psychology-based resistance training model for the elderly is acceptable, attractive, appropriate, useful, and can be implemented by the elderly.

## References

- [1] Badan Pusat Statistik. (2019). *STATISTIK LANJUT USIA 2019. Statistik Penduduk Lanjut Usia Di Indonesia 2019*.
- [2] Bompa, T., & Haff, G. (2009). *Theory and Methodology Of Training Fifth Edition*. In Orietta Calcina.
- [3] Borg, W. R., & Gall, M. D. (1984). *Educational research: An introduction*.
- [4] BPS. (2019). *Statistik Penduduk Lanjut Usia di Indonesia 2019*. Badan Pusat Statistik.
- [5] Cress, M. E., Buchner, D. M., Prohaska, T., Rimmer, J., Brown, M., Macera, C., DePietro, L., & Chodzko-Zajko, W. (2004). Physical activity programs and behavior counseling in older adult populations. *Medicine and Science in Sports and Exercise*. <https://doi.org/10.1249/01.MSS.0000145451.08166.97>
- [6] D.L., R., M.J., D., A., J., P.M., J., & N.D., C. (2019). Affective responses to supervised 10-week programs of resistance exercise in older adults. *Journal of Sport and Health Science*.
- [7] Dewi, S. K. (2018). *Level Aktivitas Fisik dan Kualitas Hidup Warga Lanjut Usia*. Media Kesehatan Masyarakat Indonesia. <https://doi.org/10.30597/mkmi.v14i3.4604>
- [8] Eckstrom, E., Neukam, S., Kalin, L., & Wright, J. (2020). Physical Activity and Healthy Aging. In *Clinics in Geriatric Medicine*. <https://doi.org/10.1016/j.cger.2020.06.009>
- [9] Fisher, J., Steele, J., McKinnon, P., & McKinnon, S. (2014). Strength Gains as a Result of Brief, Infrequent Resistance Exercise in Older Adults. *Journal of Sports Medicine*. <https://doi.org/10.1155/2014/731890>
- [10] Gao, X., Wang, L., Shen, F., Ma, Y., Fan, Y., & Niu, H. (2019). Dynamic walking stability of elderly people with various BMIs. *Gait and Posture*. <https://doi.org/10.1016/j.gaitpost.2018.11.027>
- [11] Granic, A., Hurst, C., Dismore, L., Davies, K., Stevenson, E., Sayer, A. A., & Aspray, T. (2019). Milk and resistance exercise intervention to improve muscle function in community-dwelling older adults at risk of sarcopenia (MilkMAN): Protocol for a pilot study. *BMJ Open*. <https://doi.org/10.1136/bmjopen-2019-031048>
- [12] Herrod, P. J. J., Lund, J. N., & Phillips, B. E. (2021). Time-efficient physical activity interventions to reduce blood pressure in older adults: a randomised controlled trial. *Age and Ageing*. <https://doi.org/10.1093/ageing/afaa211>
- [13] Ige-Elegbede, J., Pilkington, P., Gray, S., & Powell, J. (2019). Barriers and facilitators of physical activity among adults and older adults from Black and Minority Ethnic groups in the UK: A systematic review of qualitative studies. In *Preventive Medicine Reports*. <https://doi.org/10.1016/j.pmedr.2019.100952>
- [14] Jehu, D., Paquet, N., & Lajoie, Y. (2017). Balance and mobility training with or without concurrent cognitive training does not improve posture, but improves reaction time in healthy older adults. *Gait and Posture*.

- <https://doi.org/10.1016/j.gaitpost.2016.12.006>
- [15] Kenney, W. L., Wilmore, J. H., & Costil, D. L. (2015). *Physiology of Sport and Exercise*. Sixth Edition. In *Human Kinetics*.
- [16] Kuo, C.-H. (2019). Exercise Against Aging: Darwinian Natural Selection Among Fit and Unfit Cells Inside Human Body. *Journal of Science in Sport and Exercise*. <https://doi.org/10.1007/s42978-019-0002-y>
- [17] Lin, L., Lo, M. S. W., Yang, N.-H., & Li, G.-J. (2019). Different Exercise Training On Reaction Time In Older Adults With Mild Cognitive Impairment. *Medicine & Science in Sports & Exercise*. <https://doi.org/10.1249/01.mss.000056113.9.91510.3f>
- [18] Medawati, R., Haryanto, J., & Ulfiana, E. (2020). Analisis Faktor Successful Aging Pada Lansia Yang Bekerja Sebagai Petani. *Indonesian Journal of Community Health Nursing*. <https://doi.org/10.20473/ijchn.v5i1.18704>
- [19] Mekari, S., Neyedli, H. F., Fraser, S., O'brien, M. W., Martins, R., Evans, K., Earle, M., Aucoin, R., Chiekwe, J., Hollohan, Q., Kimmerly, D. S., & Dupuy, O. (2020). High-intensity interval training improves cognitive flexibility in older adults. *Brain Sciences*. <https://doi.org/10.3390/brainsci10110796>
- [20] Miller, R. M., Bembem, D. A., & Bembem, M. G. (2021). Skeletal muscle adaptations following 80 weeks of resistance exercise in older adults. *Journal of Geriatric Physical Therapy*. <https://doi.org/10.1519/JPT.0000000000000302>
- [21] Nassaji, H. (2015). Qualitative and descriptive research: Data type versus data analysis. In *Language teaching research* (Vol. 19, Issue 2, pp. 129–132). Sage Publications Sage UK: London, England.
- [22] Ostrov, J. M., & Hart, E. J. (2012). Observational methods. In *Oxford handbook of quantitative methods* (Vol. 1). Oxford University Press New York, NY.
- [23] Paquot, M., & Plonsky, L. (2017). Quantitative research methods and study quality in learner corpus research. *International Journal of Learner Corpus Research*, 3(1), 61–94.
- [24] Porcari, J. P., Bryant, C. X., & Comana, F. (2015). *Exercise Physiology (Foundations of Exercise Science)* 1st Edition.
- [25] Purnama, H., & Suhada, T. (2019). Tingkat Aktivitas Fisik Pada Lansia Di Provinsi Jawa Barat, Indonesia. *Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)*, 5(2), 102–106. <https://doi.org/10.33755/jkk.v5i2.145>
- [26] Ribeiro, A. S., Nunes, J. P., & Schoenfeld, B. J. (2020). Selection of Resistance Exercises for Older Individuals: The Forgotten Variable. *Sports Medicine*. <https://doi.org/10.1007/s40279-020-01260-5>
- [27] Seco, J., Abecia, L. C., Echevarría, E., Barbero, I., Torres-Unda, J., Rodriguez, V., & Calvo, J. I. (2013). A long-term physical activity training program increases strength and flexibility, and improves balance in older adults. *Rehabilitation Nursing*. <https://doi.org/10.1002/rnj.64>
- [28] Villareal, D. T., Aguirre, L., Gurney, A. B., Waters, D. L., Sinacore, D. R., Colombo, E., Armamento-Villareal, R., & Qualls, C. (2017). Aerobic or Resistance Exercise, or Both, in Dieting Obese Older Adults. *New England Journal of Medicine*. <https://doi.org/10.1056/nejmoa1616338>
- [29] WHO. (2016). WHO | Proposed working definition of an older person in Africa for the MDS Project. In World Health Organization.
- [30] World Health Organization. (2020). WHO Guidelines on physical activity, sedentary behaviour. In World Health Organization.