HALAMAN OLAHRAGA NUSANTARA (HON)
Jurnal Ilmu Keolahragaan

Volume 7 No I
Tahun 2024

ISSN 2614-2775 (Print)
ISSN 2621-8143 (Online)

BODY MASS INDEX, PHYSICAL ACTIVITY STATUS, AND SLEEP DURATION OF ELDERLY

Marisa Noviyanti Fajrah Ilsya[1], Dadan Resmana[2], Muhamad Fahmi Hasan[3], Nia Sri Ramania[4], Imam Safei[5]
Universitas Pendidikan Indonesia[1], Institut Teknologi Bandung[2,3,4],
Institut Teknologi Sumatra[5]
marisa.nfi@upi.edu

Abstract
Regular physical activity by vulnerable populations such as the elderly can improve physical and mental function and reduce the risk of dementia. However, awareness of doing physical activity is still low among the elderly, especially in the city of Bandung. Therefore, this study aims to determine the level of physical activity, BMI, and sleep duration of the elderly in the city of Bandung. This study used a quantitative descriptive method without a control group and assessed the level of physical activity using the International Physical Activity Questionnaire. The results of this study indicate that the average (SD) age, height, weight, and BMI of the study subjects were 56.88 ± 5.32 years, 155.8 ± 7.66 cm, 66.84 ± 12.46 respectively kg, and 27.8 ± 3.8 kg/m2. Meanwhile, the average physical activity status and sleep time of the research subjects were 452.68 ± 76.88 METs, and 344.48 ± 46.28 minutes, respectively. The conclusion of this study shows that the elderly in Kiaracondong District, Bandung City, West Java Province have a low level of physical activity and are in the category of obesity or overweight. However, the resulting sleep duration is still included in the recommended category.

Keywords: *Elderly; Physical Activity; West Java*

Submitted : 13th of June 2023
Accepted : 25th of November 2023
Published : 30th of November 2023
Correspondence Author: Marisa Noviyanti Fajrah Ilsya, Universitas Pendidikan Indonesia.
E-Mail: marisa.nfi@upi.edu

DOI http://dx.doi.org/10.31851/hon.v7i1.11980

INTRODUCTION

Pysical activity is generally identified as a part of protection against non-communicable diseases such as chronic diseases such as hypertension, cardiovascular disease, stroke, diabetes, osteoporosis, several types of cancer, and others (Celis-Morales et al., 2017; Pantelić et al., 2012). In addition, physical activity that is carried out regularly, gradually, and continuously has a positive impact on increasing cardiovascular, vascular, and respiratory capacity in the general population (Avila-Palencia et al., 2019; Bahri et al., 2021; Wen et al.,

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

2019). Meanwhile, regular physical activity by vulnerable populations such as the elderly can improve physical and mental function and reverse some of the effects of cardiovascular disease and dementia. In addition, the physical activities carried out can keep the elderly moving and become more independent (Crespillo-Jurado et al., 2019; Ferrari et al., 2013; Seo et al., 2021).

Despite the widely publicized benefits of physical activity, the majority of older adults generally do not meet the minimum level of physical activity required to maintain good health. Previous research stated that the elderly in Serang City, Salatiga City, Sukoharjo Regency have a tendency to have a low level of physical activity (Anugrah et al., 2021; Baga et al., 2017; Nisa & Jatmiko, 2019). The same thing happened in several other countries such as Serbia and Korea which stated that the elderly in these countries had a low level of physical activity (Kostić et al., 2011; Pantelić et al., 2012).

The low physical activity carried out by the elderly is due to the fact that they spend more energy on daily household activities than doing physical activities. In addition, the development of the digital era and the internet at this time is so massive that everything can be done more easily and practically, thus supporting work to be completed more quickly. However, this convenience has a negative impact on the level of physical activity which decreases in the elderly.

The low level of physical activity in the elderly population significantly increases the risk of obesity or overweight. Being overweight in the elderly has serious health impacts such as urinary incontinence, diabetes, cardiovascular disease, arthritis, hypertension, and several types of cancer (Amarya et al., 2014). In addition, the lack of sleep duration in the elderly, especially under certain conditions, can cause digestive disorders which are closely related to overweight in the elderly population.

Physical activity levels are commonly utilized as a metric to assess and appraise public health, and are invariably correlated with an individual's health status. The monitoring of physical activity levels is of great significance as it

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

serves to forestall sundry illnesses and sedentariness, whilst decreasing mortality rates among the elderly population. Several studies regarding the level of physical activity have been conducted on college students several times (Gunawan et al., 2019; Sunadi & Permana, 2017), and school children (Hasan, 2020). However, research on the level of physical activity in the elderly and the duration of sleep in the elderly as another important parameter is still limited, especially in the city of Bandung.

According to the described research background, it is imperative to determine the physical activity level, BMI, and sleep duration of elderly individuals residing in the city of Bandung. Such information would enable the development of programs and recommendations for relevant stakeholders regarding the significance of physical activity awareness, particularly in the elderly population.

METHOD

The respondent criteria used were the elderly with an age range of 50-65 years who came from the Kiaracondong District, Bandung City, West Java Province. A total of 60 respondents were successfully taken in this study and are expected to provide an accurate description of the characteristics of the elderly in the region.

This research was conducted from April to June 2022. A purposive sampling technique was used to recruit respondents with the respondent criteria used being elderly people with an age range of 50-65 years who come from the Kiaracondong District area of Bandung City, West Java Province. A total of 60 respondents were successfully taken in this study and are expected to provide an accurate description of the characteristics of the elderly in the region. Prior to data collection, research participants were given written consent as the main requirement. The research protocol was also approved by the Health Polytechnic Health Research Ethics Commission, Ministry of Health, Bandung (No.

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

06/KEPK//EC/XII/2022). So that the steps taken in this study have met the ethical and legal standards that apply in the field of scientific research.

Equation and formula

The International Physical Activity Questionnaire (IPAQ) was employed as the research instrument in this investigation, and this was used in conjunction with anthropometry, which included height, weight, and body mass index. The outputs of the IPAQ questionnaire were represented by Metabolic Equivalent (METs) values, which encompassed three distinct criteria, namely low, medium, and high levels of physical activity. Insufficient physical activity was represented by MET values of less than 600, whilst moderate physical activity was characterized by MET values within the range of 600 to 3000. Higher levels of physical activity were denoted by MET values that exceeded 3000. Height was measured utilizing digital scales and a stadiometer.

The Body Mass Index (BMI) was measured using the BrianMac Sports Coach formula, which takes into account both height and weight (kg/m2). The data collected was subjected to analysis using the One Sample T-Test statistical technique with a 95% confidence interval, and the SPSS version 22 software was employed for this purpose. Thus, the use of accurate and tested research methods and instruments has been carried out to ensure the integrity of the data obtained, so that the research results can be relied upon in drawing conclusions and recommendations.

RESULT AND DISCUSSION

Result

In this result, we get data about age, height, weight, body mass index, physical acitivity and sleep duration. This mean (SD) of age, height, weight, and BMI of the study subjects were 56.88 ± 5.32 years, 155.8 ± 7.66 cm, 66.84 ± 12.46 kg, and 27, respectively. 8 ± 3.8 Kg/m2 shown in table 1.

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

Table 1. Profiling Subject

No	Variable	Results
1.	Age (years)	56,88 ± 5,32
2.	Height (cm)	155,8 ± 7,66
3.	Weight (kg)	66,84 ± 12,46
4.	Body Mass Index (BMI)	27,1 ± 3,8

Table 2 shows the average physical activity status and sleep time of the research subjects, respectively 452.68 ± 76.88 METs, and 344.48 ± 46.28 minutes.

Tabel 2. Physical Activity and Sleep Duration

No	Variable	Results
1.	Physical Activity (METs)	452,68 ± 76,88
2.	Sleep Duration (minute)	344,48 ± 46,28

Discussion

The primary objective of this study was to ascertain the physical activity status, anthropometry, and sleep duration of elderly individuals residing in a sub-district within Bandung City, located in the West Java Province. To the author's knowledge, this is the first measurement conducted on the elderly in the area and is expected to provide an accurate picture of the characteristics of the elderly in the area. In the research that we have done, the participants who were the subject of this study had an average age of 56.88 ± 5.32. According to data released by the World Health Organization (WHO) and the Ministry of Health of the Republic of Indonesia (Depkes RI), this age is included in the elderly category. In addition, we found that the participants' BMI was at 27.8 ± 3.8, which according to the WHO and the Indonesian Ministry of Health was in the overweight or obese category.

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

Our findings are in line with previous research which stated that BMI elderly in Serang City tended to be overweight or obese (Anugrah et al., 2021). This confirms that the elderly in big cities in West Java and Banten are in the overweight or obese category. Moreover, the outcomes of our study exhibit notable similarities with those of prior research endeavors that explored the prevalence of obesity among elderly individuals in several developing nations. A previous study revealed that the elderly population in such countries exhibited an average body mass index (BMI) of 27.8, signifying a high prevalence of obesity in this demographic (Jésus et al., 2017; Pantelić et al., 2012).

The findings in our study show differences from several previous studies that examined elderly populations in several developed countries. Several of these investigations arrived at the determination that elderly individuals in developed nations possessed a body mass index that falls within the normal range, and are not considered obese obese (Masood & Reidpath, 2017; Tarui et al., 2020). This phenomenon may be attributable to the increased awareness and knowledge regarding nutrition, health, and healthier lifestyles that exist in developed nations (Hutapea & Intelegence, 2013; Masood & Reidpath, 2017; Tarui et al., 2020).

However, the results from our study suggest that there is a prevalence of obesity in the elderly population in the countries we studied. This emphasizes the importance of studying the factors that contribute to the problem of obesity in the elderly population, as well as formulating appropriate interventions to prevent and treat this problem. Conducting an examination of the factors that contribute to the issue of obesity or being overweight is crucial due to the fact that obesity is a public health concern that can lead to various disease complications and represents a risk factor for the development and mortality of several ailments. Obesity has the potential to trigger cardiovascular disease, metabolic disorders, respiratory difficulties, and cancer (Jésus et al., 2017).

Increasing the role of the central and regional governments in dealing with obesity rates in the elderly population is very important to achieve a healthy life

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

expectancy in old age. This action aims to prevent the emergence of various diseases due to obesity which can interfere with quality of life. This is realized by the Central Government in Law number 11 of 2022 concerning sports article 4 which states that the purpose of sports is to maintain health, improve fitness levels, and improve the quality of Indonesian people, including the elderly. In addition, previous study that adapted the copy from Article 19 of Law number 11 of 2022 it is stated that types of community sports can be carried out by all levels of society with the aim of maintaining health, recovering from illness, and maintaining to improve the degree of fitness and body health (Bahri et al., 2021; Kamaludin et al., 2020; Nuriman et al., 2016). Whereas the Regional Government of West Java in West Java Province Regional Regulation Number 1 of 2015 concerning the implementation of Sports article 3 states that the purpose of organizing sports in the West Java region is to support the achievement of sports goals nationally in accordance with the mandate of Law number 11 of 2022 concerning sports. In addition, previous study that adapted the copy from West Java Provincial Regulation Number 1 of 2015 article 3 is to popularize sports which is reflected in the people of West Java who know, understand, understand, do, and enjoy the benefits of doing sports or physical activity (Juniarto et al., 2022; Rubiana et al., 2019).

Additional findings from our study revealed that the elderly participants exhibited low levels of physical activity, as evidenced by a MET value of 452.68 ± 76.88. These findings exhibit parallels with earlier research conducted in Serang City (Anugrah et al., 2021), Salatiga City (Baga et al., 2017), and Sukoharo Regency (Nisa & Jatmiko, 2019) which indicated that the elderly population there demonstrated similarly low levels of physical activity, and in line with research conducted in Portugal to 83 elderly (Jésus et al., 2017). Numerous studies conducted in Serbia and Korea have indicated low levels of physical activity among their respective elderly populations (Kostić et al., 2011; Pantelić et al., 2012). Nevertheless, the results of our study diverge from the outcomes of studies

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

conducted in Japan, which suggested that elderly individuals in Japan tend to display high levels of physical activity, as indicated by a MET value of 1200 (Ishihara et al., 2022; Tajima et al., 2018).

The high METs score of elderly people from Japan is due to intervention by the Japanese government. In reducing obesity rates and increasing physical activity in the elderly, the Japanese state through the Ministry of Health and Welfare carries out an intensive lifestyle intervention policy in the context of annual health checks. The implementation of this measure served as an economically viable preventive strategy against disorders linked to obesity, while concurrently facilitating the identification of target groups at greater risk of weight gain (Tajima et al., 2018; Tarui et al., 2020).

Overall, it can be inferred that the elderly population exhibits lower scores for physical activity compared to other demographic groups (Pantelić et al., 2012; Tomioka et al., 2011). The elderly's low physical activity levels may be attributed to the fact that they expend a greater amount of energy on daily household activities such as laundry, dishwashing, ironing, and other similar tasks, with only a minor portion of their energy being allocated towards physical activity. This is particularly important to note given that low physical activity has been associated with a comparable risk of death from diseases such as high blood pressure and obesity. Therefore, it is necessary to take appropriate actions by related parties to increase physical activity in the elderly in the city of Bandung so that the risk of disease can be minimized.

Other results in our study showed that the sleep duration of the elderly who were the subjects of the study was 344.48 ± 46.28 minutes. According to guidelines issued by the Ministry of Health, ages 40-60 years need around 7 hours of sleep per night. Our research shows that the average elderly sleep for 6.5 hours, almost close to the recommendation from the Ministry of Health. Sleep deprivation among the elderly can result in obesity or being overweight, elevate

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

stress levels, reduce cognitive function, and worsen overall physical health conditions (Kemenkes RI, 2018).

Various studies have emphasized the crucial role of physical activity in preventing diseases and promoting physical and cognitive health. Moreover, the quality of life of the elderly is dependent on factors such as engaging in physical activity, experiencing life satisfaction, and having strong social connections (Ferrari et al., 2013; Mayer et al., 2011; Meng et al., 2017). Several researchers have demonstrated that consistent participation in physical activity, engagement in recreational activities, sleeping for 7-8 hours each day, and maintaining a body mass index (BMI) within a healthy range that is neither underweight nor obese are key factors that predict a healthy lifestyle and an increased lifespan (Neikrug & Ancoli-Israel, 2013).

The phenomenon of low physical activity and high levels of obesity in the elderly in Bandung City which was revealed in this study should be taken into consideration by related parties, such as the Health Service and agencies dealing with the elderly in Bandung City and West Java Province. This action needs to be taken to pay attention to these conditions and find the right solution to improve the health and quality of life of the elderly, so that the life expectancy of the elderly can increase.

CONCLUSION

The study findings and discussion lead to the conclusion that the elderly residing in the Kiaracondong District of Bandung City, West Java Province, have a low level of physical activity and fall within the obese or overweight category. However, the resulting sleep duration is still included in the category recommended by the Ministry of Health of the Republic of Indonesia and WHO. To ensure the clinical relevance of this specialized field, further research is necessary to expand the sample size and include all elderly individuals in the city of Bandung. This will provide a more comprehensive understanding of the characteristics of the elderly populationt.

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

REFERENCES

Amarya, S., Singh, K., & Sabharwal, M. (2014). Health consequences of obesity in the elderly. *Journal of Clinical Gerontology and Geriatrics*, *5*(3), 63–67. https://doi.org/10.1016/j.jcgg.2014.01.004

Anugrah, S. M., Rian Triprayogo, Ida Zubaida, & Bimo Alexander. (2021). Physical Activity and Body Mass Index Status of Elderly in Serang Banten Province. *JUARA : Jurnal Olahraga*, *6*(1).

Avila-Palencia, I., Laeremans, M., Hoffmann, B., Anaya-Boig, E., Carrasco-Turigas, G., Cole-Hunter, T., de Nazelle, A., Dons, E., Götschi, T., Int Panis, L., Orjuela, J. P., Standaert, A., & Nieuwenhuijsen, M. J. (2019). Effects of physical activity and air pollution on blood pressure. *Environmental Research*, *173*(December 2018), 387–396. https://doi.org/10.1016/j.envres.2019.03.032

Baga, H. D. S., Sujana, T., & Triwibowo, A. (2017). Perspektif Lansia Terhadap Aktivitas Fisik Dan Kesejahteraan Jasmani Di Desa Margosari Kota Salatiga Jawa Tengah. *Jurnal Ilmu Keperawatan Dan Kebidanan*, *8*(2), 89. https://doi.org/10.26751/jikk.v8i2.278

Bahri, S., Resmana, D., Tomo, H. S., & Apriantono, T. (2021). The effect of exercising under particulate matter 2.5 conditions on forced vital capacity and blood lead levels. *Physiotherapy Quarterly*, *29*(3), 24–27. https://doi.org/10.5114/pq.2020.100288

Celis-Morales, C., Salas, C., Martínez, M. A., Leiva, A. M., Garrido-Méndez, A., & Díaz-Martínez, X. (2017). The economic burden of physical inactivity in Chile. *Revista Medica de Chile*, *145*(8), 1091–1092. https://doi.org/10.4067/s0034-98872017000801091

Crespillo-Jurado, M., Delgado-Giralt, J., Reigal, R. E., Rosado, A., Wallace-Ruiz, A., de Mier, R. J. R., Morales-Sánchez, V., Morillo-Baro, J. P., & Hernández-Mendo, A. (2019). Body composition and cognitive functioning in a sample of active elders. *Frontiers in Psychology*, *10*(JULY), 1–8. https://doi.org/10.3389/fpsyg.2019.01569

Ferrari, R., Kruel, L. F. M., Cadore, E. L., Alberton, C. L., Izquierdo, M., Conceição, M., Pinto, R. S., Radaelli, R., Wilhelm, E., Bottaro, M., Ribeiro, J. P., & Umpierre, D. (2013). Efficiency of twice weekly concurrent training in trained elderly men. *Experimental Gerontology*, *48*(11), 1236–1242. https://doi.org/10.1016/j.exger.2013.07.016

Gunawan, S., Ramania, N. S., Gunawan, S., Sunadi, D., Studi, P., Keolahragaan, M., & Farmasi, S. (2019). *Minat Pembangunan kesehatan di Indonesia*.

Hasan, M. F. (2020). *Pemetaan Tingkat Aktivitas Fisik Siswa Sekolah Dasar Kota*

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

Bandung. *2*(502).

Hutapea, B., & Intelegence, E. (2013). Emotional Inteligence dan Psychological Well-being pada Manusia Lanjut Usia Anggota Organisasi berbasis Keagamaa ... *Jurnal Insan Media Psikologi*, *10*(1), 64–73. https://www.academia.edu/download/38959024/INSAN_Vol._13_No._02__Agustus_2011.pdf

Ishihara, Y., Ozaki, H., Nakagata, T., Yoshihara, T., Natsume, T., Kitada, T., Ishibashi, M., Deng, P., Yamada, Y., Kobayashi, H., Machida, S., & Naito, H. (2022). Association between Daily Physical Activity and Locomotive Syndrome in Community-Dwelling Japanese Older Adults: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, *19*(13), 1–12. https://doi.org/10.3390/ijerph19138164

Jésus, P., Guerchet, M., Pilleron, S., Fayemendy, P., Maxime Mouanga, A., Mbelesso, P., Preux, P. M., & Desport, J. C. (2017). Undernutrition and obesity among elderly people living in two cities of developing countries: Prevalence and associated factors in the EDAC study. *Clinical Nutrition ESPEN*, *21*(January 2018), 40–50. https://doi.org/10.1016/j.clnesp.2017.05.007

Juniarto, M., Subandi, O. U., & Sujarwo, S. (2022). Edukasi Olahraga Dalam Upaya Meningkatkan Kebugaran dan Kesehatan Masyarakat Kota Bekasi Provinsi Jawa Barat. *Dharma Raflesia : Jurnal Ilmiah Pengembangan Dan Penerapan IPTEKS*, *20*(1), 16–23. https://doi.org/10.33369/dr.v20i1.18759

Kamaludin, Ngadiman, Festiawan, R., Kusuma, I. J., & Febriani, A. R. (2020). Pengembangan Permainan Pecah Piring Sintren : Pemanfaatan Olahraga Tradisional Pada Pembelajaran untuk Meningkatkan Kemampuan Motorik Kasar Anak. *TEGAR: Journal of Teaching Physical Education in Elementary SchoolJournal of Teaching Physical Education in Elementary School*, *3*(5), 37–45.

Kemenkes RI. (2018). Hasil Utama RISKESDAS 2018. *Kementerian Kesehatan Republik Indonesia*.

Kostić, R., Uzunović, S., Pantelić, S., & Đurašković, R. (2011). A Comparative Analysis of the Indicators of the Functional Fitness of the Elderly. *Physical Education and Sport*, *9*(2), 161–171.

Masood, M., & Reidpath, D. D. (2017). Effect of national wealth on BMI: An analysis of 206,266 individuals in 70 low-, middle-and high-income countries. *PLoS ONE*, *12*(6). https://doi.org/10.1371/journal.pone.0178928

Mayer, F., Scharhag-Rosenberger, F., Carlsohn, A., Cassel, M., Müller, S., & Scharhag, J. (2011). Intensität und effekte von krafttraining bei älteren.

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

Deutsches Arzteblatt, *108*(21), 359–364. https://doi.org/10.3238/arztebl.2011.0359

Meng, G., Wang, H., Pei, Y., Li, Y., Wu, H., Song, Y., Guo, Q., Guo, H., Fukushima, S., Tatefuji, T., Wang, J., Du, H., Su, Q., Zhang, W., Shen, S., Wang, X., Dong, R., Han, P., Okazaki, T., … Niu, K. (2017). Effects of protease-treated royal jelly on muscle strength in elderly nursing home residents: A randomized, double-blind, placebo-controlled, dose-response study. *Scientific Reports*, *7*(1), 6–14. https://doi.org/10.1038/s41598-017-11415-6

Neikrug, A. B., & Ancoli-Israel, S. (2013). Sleep in Older Adults. *Encyclopedia of Sleep*, *30*(3), 654–658. https://doi.org/10.1016/B978-0-12-378610-4.00517-9

Nisa, O. S., & Jatmiko, A. W. (2019). Hubungan Antara Tingkat Aktivitas Fisik dengan Fungsi Kognitif Pada Lanjut Usia. *Jurnal Berita Ilmu Keperawatan*, *12*(2), 59–64. https://doi.org/10.23917/bik.v12i2.9805

Nuriman, R., Kusmaedi, N., & Yanto, S. (2016). Pengaruh Permainan Olahraga Tradisional Bebentengan terhadap Kemampuan Kelincahan Anak Usia 8-9 Tahun. *Jurnal Terapan Ilmu Keolahragaan*, *1*(1), 29. https://doi.org/10.17509/jtikor.v1i1.1550

Pantelić, S., Ranđelović, N., Milanović, Z., Trajković, N., Sporiš, G., & Kostić, R. (2012). Physical Activity of Elderly Women in Terms of Age □. *Physical Education and Sport*, *10*(4), 289–296. https://bib.irb.hr/datoteka/630078.pe201204-02.pdf

Rubiana, I., Mulyana, F. R., & Priana, A. (2019). Memasyarakatkan Olahraga Dan Mengolahragakan Masyarakat Melalui Senam Umum. *Abdimas Siliwangi*, *03*(01), 130–137.

Seo, Y. K., Won, C. W., & Soh, Y. (2021). Associations between body composition and cognitive function in an elderly Korean population: A cohort-based cross-sectional study. *Medicine*, *100*(9), e25027. https://doi.org/10.1097/MD.0000000000025027

Sunadi, D., & Permana, T. (2017). Status Aktivitas Fisik, Antropometri, Dan Tingkat Kebugaran Mahasiswa Tpb Itb. *Jurnal Sains Keolahragaan Dan Kesehatan*, *2*(1), 5. https://doi.org/10.5614/jskk.2017.2.1.2

Tajima, T., Saito, Y., Kato, R., Kibayashi, Y., Miyachi, M., Lee, I.-M., & Oguma, Y. (2018). Awareness of physical activity promotion, physical activity, and sedentary behavior in elderly Japanese. *The Journal of Physical Fitness and Sports Medicine*, *7*(2), 113–119. https://doi.org/10.7600/jpfsm.7.113

Tarui, I., Okada, E., Okada, C., Saito, A., & Takimoto, H. (2020). Trends in BMI

HALAMAN OLAHRAGA NUSANTARA
JURNAL ILMU KEOLAHRAGAAN
Jendral A. Yani Street Lorong Gotong Royong 9/10 Ulu Palembang South Sumatera
email jurnal: jurnalhon@univpgri-palembang.ac.id
situs web: http://www.univpgri-palembang.ac.id

among elderly Japanese population: Findings from 1973 to 2016 Japan National Health and Nutrition Survey. *Public Health Nutrition*, *11*. https://doi.org/10.1017/S1368980019004828

Tomioka, K., Iwamoto, J., Saeki, K., & Okamoto, N. (2011). Reliability and validity of the international physical activity questionnaire (IPAQ) in elderly adults: The Fujiwara-kyo study. *Journal of Epidemiology*, *21*(6), 459–465. https://doi.org/10.2188/jea.JE20110003

Wen, D., Utesch, T., Wu, J., Robertson, S., Liu, J., & Hu, G. (2019). Effects of different protocols of high intensity interval training for VO2max improvements in adults: A meta-analysis of randomised controlled trials. *Journal of Science and Medicine in Sport*, 1–7. https://doi.org/10.1016/j.jsams.2019.01.013