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Original Research

Correlation of Fitness Levels with Physical Activity in Elderly Patients in Yogyakarta, Indonesia

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ABSTRACT

Background: *Fitness is closely linked to aerobic capacity, which depends on the availability of oxygen to meet the needs of the blood and facilitate the burning process to provide energy to maximise the performance of the body's organs. Under certain conditions, such as disabilities, reduced function, or certain diseases that prevent physical activity, especially in the elderly, the aerobic process may not function optimally. This study investigates the correlation between fitness level and physical activity in elderly patients at the Muhammadiyah Community Welfare Development Hospital (RS PKU) in Bantul, Yogyakarta.*

Methods: *The research design is cross-sectional, using purposive sampling. To assess fitness and physical activity levels, the six-minute walk test (6MWT) and the Global Physical Activity Questionnaire (GPAQ) were used in the study. Thirty-six (36) responded to the questionnaires and participated in the study. The analysis of the data was performed using the Spearman rank correlation test.*

Results: *The Pearson correlation test showed that there was a significant correlation (r = 0.657** and p-value = 0.000) between fitness level and physical activity.*

Conclusion: *There is a strong correlation between fitness level and physical activity in elderly patients at PKU Muhammadiyah Bantul.*

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INTRODUCTION

Physical inactivity is increasing globally, with negative consequences for public health and an enormous burden on health services, and is estimated to be a major risk factor for causes of death worldwide (Kind et al., 2019). Higher levels of cardiorespiratory fitness are associated with a reduced risk of cardiovascular disease and death, as in other diseases. According to the study Letnes et al (2023), age and VO2 max were the two characteristics that had the greatest impact on predicting mortality in the cardiac rehabilitation setting.

Physical fitness is a fundamental requirement for individuals to perform daily activities adequately. The definition of physical fitness is the body's capacity to perform daily activities without experiencing excessive fatigue. Fitness is synonymous with physical wellbeing, encompassing a person's ability to engage in daily activities with ease and without experiencing excessive fatigue, whilst also retaining sufficient energy reserves for other physical pursuits. An individual's level of physical fitness directly correlates with their work capacity (Kisiel-Sekura et al., 2024).

Fitness is essential to achieving optimal health and endurance and is an important public health concern. Fitness is closely linked to aerobic capacity, which depends on the availability of oxygen to meet the body's energy needs by aiding the combustion process. This optimises the performance of organs such as the heart, lungs, and blood vessels by facilitating the transport of oxygen, ensuring efficient energy conversion (Firdausi et al., 2021). The aerobic process may not function optimally due to a variety of factors, such as disruptions, functional limitations, or specific medical conditions, which may affect an individual's ability to perform exercise optimally, especially for the elderly.

Elderly is an advanced life stage characterised by a decline in both physical and psychological ability and function. The World Health Organisation (WHO) categorizes the elderly into several age groups, which are: middle age (45-59 years), elderly (60-74 years), old (75-90 years), and very old (90 years and above). Global population growth is leading to an aging population with more than 962,000,000 people over the age of 60, more than 7% of the total population, according to data collected by the World Health Organisation (WHO) between 2019 and 2050. It is predicted that this figure will increase by around 100,000,000 elderly individuals in 2050 (Heri et al., 2022).

The global population has entered an aging phase, where over 7% of individuals are 60 years old or older. In Indonesia, the majority of elderly individuals fall into the young elderly category (60-69 years) at 64.29%, with 27.23% classified as middle elderly (70-79 years) and 8.49% classified as old elderly (80+ years) (Yuniarsih et al., 2021). This year, six provinces, namely the Special Region of Yogyakarta (14.71%), Central Java (13.81%), East Java (13.38%), Bali (11.58%), North Sulawesi (11.51%), and West Sumatra (10.07%), have an aged population structure where the elderly population reaches 10% (Setiawati et al., 2021).

Generally, the ageing process begins at around 45 years of age and leads to issues by the age of approximately 60 years. Common problems among elderly individuals include those related to the cardiovascular system, resulting from changes in physiological function and decreased physical activity, which affect their overall fitness. Decreased physical activity reduces skeletal muscle work and leads to an increased or fast resting heart rate due to the heart working harder. An unhealthy heart rate impedes the proper circulation of blood and oxygen throughout the body, resulting in hastened fatigue and heightened stress levels.

Such consequences lead to a reduction in cardiovascular fitness. Cardiorespiratory fitness tends to decline with age, with inactive individuals experiencing a decline of 8-10% per decade, whereas active individuals see a decline of 4-5% per decade (Tangen et al., 2022). Endurance training can be used to maintain a balance of cardiorespiratory fitness. Physical activity refers to body movement that involves skeletal muscles and greatly increases energy expenditure. This can include leisure activities or independently performing daily living activities (ADL) with low intensity, or about 3-6 meters, for at least 150 minutes per week (Rahman et al., 2021).

Poor cardiorespiratory fitness can lead to rapid fatigue during exercise due to unmet oxygen needs. VO2 max, a parameter measuring maximal oxygen utilisation per minute during maximum activity or exercise, is used to describe cardiorespiratory fitness. Elderly fitness varies depending on multiple factors, necessitating the use of VO2 max values in fitness measurements to determine a person's cardiorespiratory fitness level (Letnes et al., 2023).

Data from cardiorespiratory measurements in older adults would facilitate determining the appropriate exercise dosage to reach training objectives and enable individuals to perform physical activities without cardiorespiratory system interference. Against this backdrop and research gaps, investigators seek to understand the relationship between fitness level and physical activity in older adults at Muhammadiyah Community Welfare Development Hospital (RS PKU) in Bantul, Yogyakarta.

MATERIALS AND METHOD

This study uses cross-sectional design research, which is a study conducted based on momentary observation or in a specific period with each subject that is conducted only for one observation in the study to study the dynamics of correlation based on risk factors with effects and aims to determine the presence and absence of a relationship between fitness level and physical activity in elderly patients at PKU Muhammadiyah Bantul.

The research was conducted at PKU Muhammadiyah Bantul from March to July 2023, with the subjects being elderly patients at PKU Muhammadiyah Bantul during this period. The sample used was 36 people with an age range of 50–80 years, with sampling techniques in the study using the purposive sampling method selected based on inclusion and exclusion criteria. With the following explanation:

1. Inclusion criteria were: elderly respondents who were able to communicate; respondents who were elderly outpatients at the PKU Muhammadiyah Bantul Physiotherapy Clinic; respondents aged 50-80 years; and respondents who completed the research consent form, completed the GPAQ questionnaire, and were willing to perform the 6-minute walking test or the 6-minute walking test.
2. Exclusion, where the criteria are respondents have medical conditions such as a history of heart disease, shortness of breath, or walking with the use of assistive devices; are not taking medication that has side effects; respondents cannot be present at the time of the study.

Patients' fitness levels were measured by the six-minute walk test, which is a 6-minute walk test. Before and after the six-minute walk test, the patient's vital signs and degree of breathlessness are measured using the Borg scale. The results of the six-minute walk test are calculated to determine the level of fitness (VO2 Max). Measurements to determine the level of physical activity in the elderly by completing the GPAQ (Global Physical Activity Questionnaire). Bivariate analysis was performed using the Spearman rank correlation test with SPSS version 22.

This study has been approved by the Ethics Committee of the Faculty of Medicine, ‘Aisyiyah Yogyakarta University/PKU Muhammadiyah Bantul No. 2827/KEP-UNISA/V/2023, and has obtained permission from the Research and Development Unit of the Faculty of Medicine, ‘Aisyiyah Yogyakarta University/RS PKU Muhammadiyah Bantul.

RESULTS

Descriptive analysis

The study found that the most prevalent age group was 49 to 60 years old, with 15 samples (41.7%). There were a total of 29 female participants (80.6%) and 7 male participants (19.4%). Osteoarthritis was identified as the most common patient complaint, accounting for 25 samples (69.4%). The pretest and posttest results for diastolic blood pressure showed the highest values were between 110 and 130 mmHg, with 83.3% of participants presenting a high value in the pretest and 55.6% in the posttest, falling within the normal category.

Meanwhile, the highest recorded diastolic reading before the test was 70-85 mmHg, equating to 52.8% of the maximum reading, and the highest post-test reading was 86-110 mmHg, equating to 66.7% of the maximum reading. Pretest pulse characteristics ranged from 70-85 beats per minute in 24 samples (66.7%) and posttest pulse characteristics ranged from 86-100 beats per minute in 25 samples (69.4%). Results from the respiration examination showed normal values, with 19 samples (47.2%) exhibiting pretest values and 21-22 times per minute (30.6%) exhibiting posttest values.

The Borg scale examination was carried out to measure fatigue; the results of the most pretest Borg scale examination were a value of 8 (38.9%), or in the very heavy category, and the most posttest with a value of 10 (38.9%), or in the maximum very heavy category. According to the occupation of the patients, the most common occupation was housewife with a total of 21 people (58.3%). The results of the examination of VO2 Max using the six-minute walking test showed that the majority of VO2 Max results were in the moderate category, with 25 individuals (69.4%) falling into this category. On the basis of the GPAQ results, the most common characteristics related to patient activity were low physical activity in 23 samples (63.9%).

Table 1. Respondent Characteristics and variables of study

Variable	Category	Frequency (n)	Percentage (%)
Age	49-60 tahun	15	41,7%
	61-70 tahun	13	36.1%
	71-80 tahun	8	22,2%
Gender	Male	7	19,4%
	Female	29	80,6%
Patient Complaints	Osteoarthritis	25	69,4%
	Hernia Nucleus Pulposus	10	27,8%
	Post Stroke	1	2,8%
Blood Pressure			
Sistole Pretest	110-130 mmHg	30	83.3%
	131-145 mmHg	6	16.7%
Diastole Pretest	70-85 mmHg	19	52,8%
	86-110 mmHg	17	47,2%
Sistole Posttest	110-130 mmHg	20	55,6%
	131-145 mmHg	16	44,4%
Diastole Posttest	70-85 mmHg	12	33,3%
	86-110 mmHg	24	66,7%
Pulse			

Variable	Category	Frequency (n)	Percentage (%)
Pretest	70-85	24	66,7%
	86-100	12	33,3%
Posttest	70-85	11	30,6%
	86-100	25	69,4%
Respiration			
Pretest	17-19	22	61,1%
	20-22	14	38,9%
	23-25	0	0%
Posttest	17-19	0	0%
	20-22	23	63,9%
	23-25	13	35,1%
Borg Scale			
Pretest	8	14	38,9%
	9	12	33,3%
	10	10	27,8%
	11	0	0%
Posttest	8	7	19,4%
	9	12	33,3%
	10	14	38,9%
	11	3	8,3%
Work	Midwife	1	2,8%
	Catering	1	2,8%
	Housewife	21	58,3%
	Retired Civil Servants	7	19,4%
	Small and Medium Enterprise (SME)	2	5,6%
	Entrepreneur	4	11,1%
VO2 Max value	Very good	0	0%
	Good	5	13,9%
	Fair	25	69,4%
	Less	5	13,9%
	Very poor	1	2,8%
Physical Activity	Weight	5	13,9%
	Medium	8	22,2%
	Low	23	63,9%

Bivariate analysis

Correlation testing was used for bivariate analysis in this study. To test the correlation between physical activity variables and cardiorespiratory fitness, Spearman's rank correlation test was applied. The results of the correlation test between cardiorespiratory fitness and physical activity were r = 0.657** and p value = 0.000. The relationship between cardiorespiratory fitness and physical activity is strongly correlated; the results are shown in Table 2.

Table 2. Relationship between cardiorespiratory fitness and physical activity

Variable	Correlation Coefficient	Sig (2-tailed)	Description
VO2 Max Physical activity	0,657**	0,000	Strong correlation

DISCUSSION

Descriptive analysis

Elderly is the advanced stage of a life process characterised by a decline in the body's ability to adapt to environmental stress. The decline in the capacity of various organs, functions, and environmental stresses is natural/physiological. A normal person will be able to adapt to old age. Physical fitness is part of overall fitness. Having good physical fitness, which means being able to perform daily activities safely and effectively without significant fatigue and still having energy left over for leisure and recreational activities, will improve the quality of life of older people (Purwantini, 2021).

A factor that can influence the level of VO2 max is gender. In this study, the gender of the older people was dominated by women, namely 29 people (80.6%). Men have higher aerobic capacity than women. The difference in VO2 max between men and women is related to differences in body composition and size because the physiological bodies of men and women are different. Women have more fat than muscle in their body composition compared to men, so they have a lower VO2 max. In addition, the concentration of haemoglobin is also different between men and women.

A higher haemoglobin concentration in men than in women results in a difference in the blood's transport capacity, so men have a much higher oxygen uptake during the exercise process, so their aerobic capacity is better. This is in line with findings by Nuarti et al (2019), which indicate that haemoglobin concentration closely relates to the binding of oxygen required by the body for the energy-burning process, thus enabling men to optimally produce energy. Typically, the normal range of haemoglobin levels in men is between 13.5 and 18.0%, while in women, it's between 11.5 and 16.5%.

Women have a lower average body water volume, which can have a negative impact on their physical fitness as water acts as a catalyst in the transport of oxygen from the lungs to the body, and women typically have 20–30% smaller lungs and airways than men of the same age and height. The smaller airways in women result in increased airway resistance to some ventilation, resulting in greater work of breathing and reduced ability to increase VO2 max compared to men (Santisteban et al., 2022). Understanding the significance of physical activity in enhancing the fitness of the elderly contributes to the majority of seniors achieving sufficient physical fitness.

Various factors influence physical fitness in the elderly, such as physical activity at an unsuitable intensity (moderate intensity) (Liskustyawati et al., 2021). Lessened physical fitness can lead to early hypokinetic diseases associated with physical inactivity (Hoeger et al., 2018, cited in Purwantini, 2021). Osteoarthritis was prevalent in 69.4% of elderly participants in this study and may negatively affect physical fitness. Common symptoms, such as reduced muscle strength and pain, can limit daily activities and disrupt proteoglycan production in knee cartilage, ultimately encouraging disease progression.

Reduced physical fitness and functional capacity were among the identified consequences (Rahman et al., 2021). Knee pain when moving may create unease and

hesitation when moving in individuals with knee osteoarthritis, resulting in lowered physical and musculoskeletal activity. Reduced skeletal muscle action will cause the resting heart rate to rise, forcing the heart to work harder. This diminished heart rate may lead to poorer blood flow and oxygen distribution throughout the body, resulting in rapid fatigue and susceptibility to stress, leading to reduced cardiovascular ability (Boyette & Biagio, 2024).

Engaging in physical activity can promote optimal cardiovascular function, as it enhances the energy demands of cells, tissues, and organs, leading to heightened respiratory activity and increased venous reflux. This, in turn, leads to a direct increase in stroke volume, which amplifies cardiac output and ultimately results in an elevation of blood pressure. Consequently, the findings of this study suggest an increase in both blood pressure and pulse before and after the test, as shown in Table 1. During exercise, there is an increase in the demand for oxygen in the working muscles, resulting in the utilisation of more nutrients and the acceleration of metabolism, leading to the generation of metabolic waste.

Consequently, adaptation of the cardiovascular system is required to meet the demands of the musculoskeletal system during exercise for the provision of more nutrients and removal of metabolic waste. During exercise, a range of acute responses are observed, such as increased myocardial contractility, cardiac output, heart rate, blood pressure, pulse, respiration, and peripheral responses including vasoconstriction of general resting muscles, active kidneys, liver, spleen, and visceral muscle areas. These responses are objective and measurable physical changes that occur in response to physical activity (Fadlilah et al., 2020).

Blood pressure increases after exertion due to the need to supply body cells with higher amounts of oxygen. This is because cell metabolism accelerates to produce energy. As a result, blood circulation in the blood vessels speeds up, and the demand for blood increases. Due to the vasodilation of cardiac and skeletal muscles and vasoconstriction of arterioles, this results in the constriction of arterioles and an increase in heart work per unit time. As a result, the volume of blood in arterioles increases, leading to increased pressure.

Consequently, it can be stated that the amount of blood flowing from the arteries to the heart increases. However, in these organs, blood flow to the gastrointestinal tract and kidneys decreases. The rate of blood flow to these organs supports an increase in the metabolic activity of both, and the heart will pump blood faster. In the case of tachycardia, blood pressure significantly drops during the ventricular ejection phase while the atrioventricular valves are pulled downwards, increasing atrial capacity (King & Lowery., 2024).

This action draws blood from the great veins into the atria, contributing significantly to venous return. This explains the cause of the observed reduction in systolic pressure among certain subjects post-test. Following the test, there was an increase in respiration frequency in addition to alterations in blood pressure and pulse. This respiratory frequency increase arises from the escalated production of carbon dioxide and the high demand for O2 in the cells. The respiratory system engages in heightened CO2 elimination.

This increased rate of respiration establishes improved lung ventilation, which leads to increased O2 transportation and the acceleration of CO2 removal. Moreover, recent research by Ningsih et al (2021), demonstrates that exercise prompts an upsurge in respiratory rate in tandem with heightened oxygen consumption and carbon dioxide

production. When physical activity commences, receptors in the joints and muscles activate and bring about an initial surge in breathing. This has an impact on the pre- and post-test increase in the Borg scale.

People with exercise programs have higher fitness scores than those without. This is because the body's organ systems, such as the respiratory and cardiac organs, work more actively compared to someone who is not doing the activity. Scheduled work can improve the quality of the organs of the body, such as the respiratory response and also the heart response to the movements performed. In the long term, the organs involved will also work better.

The type of work is divided into two categories: daily work such as sweeping/mopping floors and gardening, and sports activities such as gymnastics, yoga, and light running. Research has also shown that work can affect a person's fitness. A person's fitness can be increased by work that has a high frequency and intensity (Anlya et al., 2023). Physical fitness is closely related to a person's work and movement. The physical fitness required by people to move and work is not the same for everyone, depending on the movements or work performed. Work that is done in a static position for a long time and lack of mobility can cause a decrease in cardiovascular endurance.

Bivariate analysis

Cardiorespiratory Fitness Measurement Results

The study showed that older people's VO2 max based on 6MWT results were most likely to be within the moderate category at 69.4%. Many factors influence the level of cardiorespiratory fitness, including heredity, age, gender, diet, smoking, and physical activity. Several previous studies have shown that there can be a decline in cardiorespiratory fitness with age.

Absorbing, containing, and distributing oxygen throughout the body is a challenging task for the lungs. During high-intensity and long-lasting physical activities, the body demands a significant increase in oxygen consumption owing to boosted metabolism resulting from exercise. Physiologically, the lungs must have good functional capacity and endurance to consume the maximum amount of oxygen per minute.

This is known as a person's aerobic capacity, or VO2 max. VO2 max measures the body's effectiveness in absorbing oxygen and delivering it to muscles and other cells, using it as energy while eliminating metabolic waste that can hinder physical movement (Dahlan, 2020). Oxygen (O2) is essential for endurance, as the body needs it to produce energy. However, this ability will decline with age due to various factors.

According to Zipes (2019, in Nurámalia, 2022), this decline may be due to variability in maximal heart rate and other cardiovascular parameters. Sarcopenia (decline due to ageing and skeletal muscle weakness) is also thought to contribute to the decline in cardiovascular fitness in older adults. Age-related sarcopenia is a decrease in the number, size, and function of muscle fibres.

Atrophy of muscle fibres, both fast and slow twitch, results in reduced muscle mass and strength. Increased intramuscular fat and reduced mitochondrial energy storage contribute to reduced muscle function. These factors lead to a decline in cardiovascular endurance as we age.

Physical Activity Measurement Results

Results of the analysis of physical activity measurements of the elderly at RS PKU Muhammadiyah Bantul showed that the highest mean percentage value was light intensity, namely 63.9%. Physical activity can be divided into three different categories, namely vigorous, moderate, and light, based on MET values. Heavy intensity is defined as MET/week ≥3000, moderate intensity as MET/week ≥600 to <3000, and light intensity as <600. Based on these categories, the physical activity of older women in RS PKU Muhammadiyah Bantul is classified as light-intensity physical activity.

Most of those surveyed were older women who were no longer working. Everyday respondents do housework such as sweeping, cleaning the yard, planting flowers, and gardening, and a small proportion of respondents cycle from home to somewhere else every day, a distance of ±1 km. Motorcycles are still the dominant means of transport used by respondents to commute.

In contrast, none of the respondents engage in high-intensity physical activities such as lifting heavy weights and sports activities such as running. Respondents spent more time sitting and lying down (reciting the Quran, watching television and talking to family), according to the results of the interviews conducted. Older people experience a decrease in daily activity levels as they get older. This is because the ability to perform physical activities is reduced, and it is easy to feel tired while working or doing activities.

This condition is due to a decline in the cardiorespiratory function, which is no longer as good as it was when a person was young. Older people may experience muscle wasting or atrophy as a result of reduced activity (Zahirah et al., 2022). In addition, the research explained that the decline in fitness in older people aged 70 years was 30–50%. Declining fitness in the elderly will lead to declining physical condition, which may limit daily activities in the elderly.

The process of physiological decline will be the cause of limitations in older people. This is because physical activity will have an effect on the response of the body's organs, such as the respiratory organs and also the heart organ, so that the organ makes adjustments to the changes in movement that occur.

Relationship between Fitness Level and Physical Activity in Elderly Patients at PKU Muhammadiyah Bantul Hospital

The results of the correlation test between physical activity and cardiorespiratory fitness were carried out using the Spearman rank correlation test, and the results obtained were the value of r = 0.657** and p-value = 0.000. There is a correlation between physical activity and cardiorespiratory fitness among the elderly in PKU Muhammadiyah Bantul Hospital based on the results of the Spearman rank test ($p < 0.05$). In this study, it was found that the level of physical activity of the elderly was classified as low-intensity physical activity, while the level of cardiorespiratory fitness was in the moderate category.

Physical fitness is closely related to the amount of exercise you do every day. An example of good physical activity is regular exercise, such as gymnastics in older people. Good physical activity can cause the pulse rate to increase with increasing physical activity. Physical activity can increase the pulse rate, which affects the fitness and health of a person's body. Pulse frequency increases because blood circulation increases during exercise to meet the oxygen needs of all body tissues.

Musculoskeletal limitations and disorders make older people cautious and slow down body movements during activities, so cardiorespiratory fitness is also low (Zahirah et al., 2022). Declining cardiorespiratory fitness with age also has important implications for functional independence and quality of life in the elderly. Many activities of daily living require optimal aerobic capacity. Therefore, the cardiorespiratory fitness ratio is higher in older adults than in younger adults. As a result, when an older person's activity level approaches or exceeds their aerobic capacity, they are sometimes inclined to become sedentary or to stop being active (Anlya et al., 2023).

Physical activity in older people has physiological effects on the body, namely changes in the cardiorespiratory system because the heart works more efficiently and is able to circulate more blood with fewer beats, changes in the respiratory system because of increased neuromuscular function, O2 uptake, and CO2 release become better, changes in the skeletal muscle system because the muscles become bigger and stronger, and changes in the digestive system because the function of the digestive system is strongly influenced by the amount of blood flow received during physical activity. Therefore, the more physical activity older people do, the better their fitness level will be closely related to their level of physical activity.

CONCLUSION

Based on the results and discussion presented, the research can conclude that there is a relationship between the level of fitness and physical activity of elderly patients at RS PKU Muhammadiyah Bantul with an average fitness score in sufficient condition and physical activity results in criteria for low physical activity. On the basis of the implementation and results of the research, the researchers provide advice to the public to maintain their diet, rest patterns, routine treatment in relation to the diseases they are experiencing, and most importantly, to do more physical activity on a regular basis. The results of this research can be a reference for the government in the creation of many programs that can improve the fitness, productive activities, and health of the residents of Bantul, Yogyakarta.

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