Analysis of Physical Activity and Vital Lung Capacity in Elderly Residents at the Banda Aceh Nursing Home, 2025

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Abstract. Physical activity and physical health are important components in maintaining and improving the quality of life of older adults, as the natural ageing process often leads to declines in physiological and motor functions, which can affect their ability to perform daily activities. Aerobic physical activity increases heart rate and influences lung vital capacity. Based on this description, it is necessary to conduct research to analyse the physical activity of older adults and their lung vital capacity in a nursing home setting. The method used in this study was a quantitative, descriptive, cross-sectional design, with data collected through direct spirometry and questionnaires to assess physical activity using the PASE score. The population in this study consisted of all older adults living in the nursing home. The researchers selected 60 older adults who met the inclusion criteria using a total sampling approach. They collected data using two main methods: spirometry to determine lung vital capacity and questionnaires to assess physical activity using the PASE score. Spirometry measurements included FVC and FEV1, while the PASE questionnaire covered daily activities performed by older adults. The researchers interpreted the results of this analysis to identify lung health conditions and subjects' activity levels. Based on the analysis, they concluded that physical activities performed by older adults in the nursing home—including prayer, Qur'an recitation, physical guidance, social guidance, and skills training—contribute to relatively good lung vital capacity. Spirometry values indicate that the older adults in this group have adequate vital capacity, with an FEV1/FVC ratio within the low-normal range. This study emphasises the importance of physical activity in supporting lung health and improving the quality of life of older adults.

Keywords: Physical Activity Condition; Lung Vital Capacity; Older Adults; Nursing Home.

INTRODUCTION

Indonesia is currently facing a significant demographic challenge due to rapid population ageing. According to Statistics Indonesia [1], the percentage of older adults in Indonesia reached 11.2% in 2024 and is projected to increase to 12.5% in 2025. This population ageing phenomenon has serious consequences across various aspects of life, particularly for healthcare services and the needs of older adults. The Province of Aceh, especially the City of Banda Aceh, has also experienced an increase in its elderly population, which reached 8.7% of the total population in 2024. If older adults exhibit two indicators:

1) Inadequate living conditions in terms of basic human needs;

2) Experiencing social problems such as poverty and neglect – they are categorised as Persons with Social Welfare Problems (PMKS) [2].

The increasing number of older adults is correlated with the growing need for facilities and care services, including nursing homes, that accommodate and care for older adults without families

or whose families are unable to provide adequate care.

In Banda Aceh, several nursing homes, both government – and privately managed, accommodate approximately 350 older adults with diverse backgrounds and health conditions. Active nursing homes in Banda Aceh, such as the Tresna Werdha Social Home (PSTW) Meulingoe Jroh Naguna, Transitional Homes, and others, have a total capacity of approximately 350 residents as of 2025. As the population continues to age, special attention is required to improve the quality of life of older adults, particularly those living in nursing homes. Physical activity and physical health are essential components in maintaining and enhancing their quality of life, as the natural ageing process often leads to declines in physiological and motor functions that can affect their ability to perform daily activities. Scientific studies have proven that physical activity provides significant health benefits for older adults. Various studies indicate that regular physical activity can help maintain bodily functions, prevent chronic diseases, enhance independence, and even reduce the risk of premature mortality among the elderly population. The World Health Organisation (WHO) recommends that adults aged 65 years and over engage in at least 150 minutes of moderate-intensity physical activity per week, or 75 minutes of vigorous-intensity physical activity, along with muscle-strengthening activities twice a week. However, the reality in the field often differs from these ideal recommendations. Data from the Indonesian Ministry of Health in 2023 indicate that only 33.6% of older adults meet recommended levels of physical activity, suggesting that a significant proportion remain physically inactive [3].

The low level of physical activity among older adults in nursing homes can be attributed to several factors, including declining physical and health conditions, lack of motivation, limited facilities, and the absence of structured physical activity programs tailored to older adults' needs. This situation can negatively impact their health and quality of life, including increased risk of falls, cognitive decline, social isolation, and greater dependence in performing daily activities. This research is important for ensuring older adults' rights to a good quality of life, as mandated by Law No 13 of 1998 concerning Elderly Welfare and Aceh Provincial Regulation No 11 of 2013 on Elderly Welfare [4]. Both regulations emphasise the importance of efforts to improve the health and well-being of older adults, including through physical activity and appropriate recreational programs tailored to their conditions and needs. Furthermore, in the era of the Sustainable Development Goals (SDGs), this study aligns with Goal 3, "Good Health and Well-Being" [5], which emphasises ensuring healthy lives and promoting well-being for all ages, including the elderly.

Older adults (the elderly) represent a later stage in the life process, characterised by a decline in the body's ability to adapt to environmental stress [6]. According to Law No 13 of 1998 on Elderly Welfare, which remains in effect, an older adult is defined as an individual aged 60 or older. Meanwhile, the World Health Organisation (WHO) classifies older adults into four groups: middle-aged (45–59 years), elderly (60–74 years), old (75–90 years), and very old (over 90 years) [6]. Researchers have developed various theories to explain the ageing process. According to the authors [7], these theories can be grouped into biological, psychological, and sociological perspectives.

1) Biological ageing theory explains how physiological changes occur as age increases in living organisms, including humans. This theory is divided into two main categories: programmed theories (which view ageing as following a biological timetable) and damage/error theories (which emphasise cumulative damage caused by environmental factors).

2) Psychological theories of ageing encompass various approaches to understanding mental and emotional changes that occur with advancing age.

3) Disengagement theory, a sociological perspective, suggests that ageing naturally leads older adults to withdraw from social life and interactions gradually. This withdrawal is considered a normal process that allows older individuals to prepare for the end of life while providing opportunities for younger generations.

From the theories above, it can be concluded that the continuity theory holds that patterns established earlier in life continue into old age. For example, habits related to diet, sleep patterns, and social interactions tend to persist over time. Changes that occur in older adults are therefore based on the continuation of past experiences, values, and habits. This concept is relevant to implementing adaptive physical activity programs that support and improve the quality of life for

older adults in nursing homes. Types of Physical Activity in Older Adults. Physical activity that is beneficial for older adults should meet the FITT criteria (frequency, intensity, time, and type). In this study, we define frequency as the number of times an activity is performed or the number of days per week it occurs. We define intensity as the effort required to perform the activity and classify it as low, moderate, or high. Time refers to the duration of an activity in a single session, while type refers to the kinds of physical activities performed. According to the author [8], types of physical activity for older adults include aerobic exercise, muscle strengthening, flexibility exercises, and balance training. The amount of exercise performed depends on individual goals, whether for independence, health, fitness, or performance improvement.

According to the author [9], the types of physical exercise for older adults include:

1) Aerobic exercise,

2) Muscle-strengthening exercise, and

3) Flexibility and balance exercises.

The human respiratory system is a group of organs and structures that work together to take in oxygen from the air and expel carbon dioxide from the body. This system consists of several main parts, each with a specific function in the breathing process [10]. Lung capacity is the combination of several pulmonary volume components, including tidal volume, inspiratory reserve volume, and expiratory reserve volume. It reflects the lungs' ability to hold air [11].

The spirometry indicator is based on proper inhalation. If a patient breathes too quickly or too slowly, the lungs will not fully expand. A spirometer typically has three chambers, each representing different levels of inspiratory flow. These values are usually expressed in millilitres to measure total breath volume. The three chambers in the spirometer consist of: the first chamber, with a capacity of 600 cc, marked by a red ball; the second chamber, with a capacity of 900 cc, marked by a yellow ball; and the third chamber, with the largest capacity of 1200 cc, marked by a blue ball. These colored balls are designed to provide clear visual feedback during the examination, helping to monitor inhalation performance effectively.

Lung Capacity Categories Based on FVC (Forced Vital Capacity):

1) Severe/Unhealthy Condition (< 50% of predicted): The lungs are considered in a severe or unhealthy condition when only one ball rises slightly in the spirometer tube.

2) Moderate Condition (50–60% of predicted): The lungs are categorised as moderate when only two balls rise in the spirometer tubes.

3) Mild Condition (65–79% of predicted): The lungs are considered in a mild condition when two balls rise fully, and the third ball rises only halfway.

4) Normal Condition (> 80% of predicted): The lungs are categorised as normal when all three balls in the spirometer rise completely.

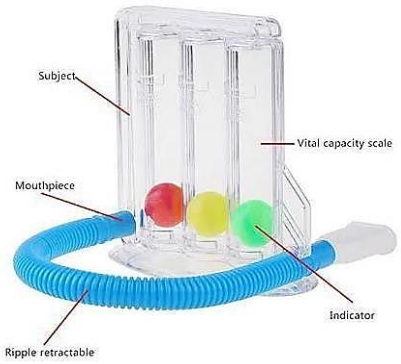

Figure 1 – Spirometry

METHOD

The study [12] employs a mixed-method approach with a cross-sectional research design. Notoatmodjo states that a cross-sectional study examines risk factors and their effects by simultaneously observing or collecting data. The selection of this design is based on the need to analyse the relationship between physical activity and the physical health of older adults in nursing homes over a specific period. A cross-sectional design allows researchers to collect data on multiple variables simultaneously, without intervention, and then analyse the relationships among them [13]. This study aims to analyse physical activity and lung vital capacity among older adults in nursing homes over a specified period. The purpose is to answer the predetermined research questions. The researchers conducted the study in May 2025 at the Banda Aceh Nursing Home, UPTD Rumoh Seujahtra Geunaseh Sayang. The conceptual framework of this study adapts the model of the relationship between physical activity and health proposed by authors [14], which illustrates the multidimensional relation-

ship between physical activity, functional capacity, and indicators of physical health in the elderly population.

This study was conducted at a nursing home in the City of Banda Aceh, namely the Rumoh Seujahtera Geunaseh Sayang Nursing Home. The selection of the research location was based on several strategic considerations as follows:

Demographic representation: The nursing home has diverse resident characteristics, including age (60–90 years), gender, socioeconomic background, and health conditions, enabling it to better represent the elderly population.

Accessibility and research permission: The nursing home has granted research permission and provided the researcher with full access to conduct data collection.

Population refers to the entire set of objects or subjects in a study. The population in this research consisted of all older adults residing at the selected nursing home, UPTD Rumoh Seujahtera Geunaseh Sayang in Banda Aceh, totalling 60 individuals. In the quantitative method, the sampling technique used was total sampling, meaning that the entire population was included as the sample.

Data analysis in this study employed a mixed-methods approach, combining quantitative and qualitative methods to obtain a more comprehensive understanding of the phenomenon under investigation. The researchers began by collecting quantitative data through surveys and statistical methods. In contrast, they collected qualitative data through in-depth interviews, observations, and document analysis. Subsequently, the researchers analysed the data separately but in a complementary manner: quantitative data using statistical techniques such as regression, ANOVA, and factor analysis, and qualitative data through transcription, coding, theme identification, and interpretation. Afterwards, they integrated data from both methods to provide a holistic view, for example, through triangulation or convergence to compare similarities and differences. Finally, they interpreted the results synergistically to answer the research questions and reported both quantitative and qualitative findings in an integrated manner, yielding deeper, more applicable insights.

RESULTS AND DISCUSSION

The results of this study reveal that the majority of older adults (55%) in the study population demonstrated moderate physical activity, with an average PASE (Physical Activity Scale for the Elderly) score of 125.3. These findings consistently support previous literature indicating a decline in physical activity with increasing age, while also highlighting the capacity of most older adults to maintain an adequate level of activity. Some readers may consider the term 'the elderly' disrespectful. Using wording that refers to people first rather than defining them by their condition or circumstance may be more effective. The PASE instrument effectively and comprehensively measures the spectrum of physical activity among older adults, encompassing household, sports, and recreational activities that are relevant to their daily lives. The significant variability in PASE scores, ranging from 45 to 210, indicates substantial heterogeneity in physical activity patterns among older adults. Factors such as health conditions, levels of social support, accessibility to sports facilities, and personal motivation are believed to be the main contributors to this variation. In general, older adults with higher PASE scores tend to engage in more physical activities, which, in turn, is positively correlated with better quality of life.

In addition to evaluating physical activity, this study also included spirometry measurements to assess lung function in older adults. The data indicate that the majority of participants (54%) experienced a decline in lung function within the mild category, with an average Forced Vital Capacity (FVC) of 2.6 ± 0.5 L, which falls within the moderate range. Only 23% of older adults maintained lung function within the normal range, while 21% experienced a moderate decline and 2% experienced a severe decline. These findings highlight that although most older adults experience a deterioration in lung function as part of the ageing process, the decline generally remains within tolerable limits. However, this condition requires serious attention to implement preventive interventions to avoid further deterioration that could lead to severe consequences. Spirometry, as a method for measuring vital capacity, has proven reliable and provides objective data on respiratory status in the elderly population. The FEV1/FVC (Forced Expiratory Volume in 1 second / Forced Vital Capacity) ratio, with an average of 0.78, indicates that most respondents do

not have significant airway obstruction, although overall lung capacity declines.

The relationship between physical activity and lung function in older adults is a crucial area that warrants further exploration. Regular physical activity, even at moderate intensity, plays an important role in maintaining lung elasticity, strengthening respiratory muscles, and improving the efficiency of gas exchange.

The decline in lung function observed in most older adults in this study, although generally mild, can be slowed by enhancing and maintaining physical activity. Other studies [for example, research on the benefits of aerobic exercise for lung function in older adults] have shown that structured exercise programs can significantly improve lung function and reduce the risk of chronic respiratory diseases. Therefore, the findings of this study reinforce the urgency of designing interventions to increase physical activity among older adults, especially those with early signs of declining lung function, as a non-pharmacological strategy to maintain quality of life and independence.

Furthermore, the heterogeneity found in both physical activity levels (PASE scores) and lung function conditions (spirometry results) highlights the need for an individualised approach in elderly care programs. Considering factors such as health conditions, social support, access to facilities, and personal motivation that influence physical activity, interventions cannot adopt a "one-size-fits-all" approach. For example, older adults with certain chronic health conditions may require specific adaptations in physical activity, while others may need stronger social support or more accessible facilities. Similarly, for those with more significant declines in lung function, physical activity programs should be tailored to minimise risks and maximise benefits, possibly by focusing on breathing exercises and controlled low-intensity activities. The integration of PASE and spirometry results can serve as a foundation for developing more personalised and effective intervention programs, aimed at slowing the rate of physiological ageing and enhancing functional resilience among older adults.

CONCLUSIONS

Based on the data obtained from the research findings and discussion regarding the analysis of physical activity and lung vital capacity in older adults using the PASE instrument and spirometry, the researchers draw the following conclusions:

Physical Activity of Older Adults: The results show that the majority engage in moderate physical activity, such as exercise, household chores, and leisurely walking, indicating that most respondents fall within the moderate activity category, followed by high and low activity levels. These findings suggest that most older adults have moderate PASE scores, as they remain actively engaged in regular physical activity.

Lung Vital Capacity: 33 older adults experienced mild declines in lung function, with the average FVC falling into the moderate category. The researchers found that 4 older adults had normal lung function, 15 showed moderate decline, and 8 had severe impairment. They attributed this condition to insufficient physical activity, which reduces the lung's oxygen-carrying capacity.

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