4'TH INTERNATIONAL CONFERENCE
ON HEALTH PRACTISE AND RESEARCH
"Prevention, detection, and treatment of cardiovascular disease"

Journal homepage: https://ojs.stikestelogorejo.ac.id/index.php/ichpr

Meta-Analysis of the Effects of Physical Exercise on Elderly Fitness

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A R T I C L E I N F O

Article history:
Received 16 January 2023
Accepted 27 February 2023

Keywords:
Fitness, Physical Exercise, Elderly

A B S T R A C T

Background: Increasing age can cause cardiorespiratory fitness conditions to decrease so that which can affect daily activities in the elderly. **Purpose:** To determine the effect of physical exercise on fitness in the elderly. **Subject and Method:** This study is a systematic review and meta-analysis conducted using PRISMA flow diagrams. Article searches through the journal database include: PubMed, Science Direct, Google Scholar, and PEDro by selecting articles published in 2013-2022. The keywords used are*("Fitness" OR "Wellness") AND ("Physical Activity" OR "Exercise") AND ("Elderly" OR "Older Adults") AND "randomized controlled trial"*. The inclusion criteria are full articles *paper articles* with the Randomized Controlled Trial (RCT) research method, the relationship size used with the Mean SD, the intervention given as physical exercise, the research subjects were elderly > 60 years old, and experienced a decrease in fitness level. Articles that met the requirements were analyzed using the Revman 5.3 application. **Results:** Meta-analysis of 5 articles shows that physical exercise can increase fitness in the elderly by 0.24 times compared to other interventions or no intervention. (SMD 0.24; 95% CI= -0.01 to 0.48; p=0.19). **Conclusion:** Physical exercise has a weak effect on the fitness of the elderly.

INTRODUCTION

The Elderly is the final stage of the aging process. Aging is a state that happens in human life. The aging process is a long process of life, not just starting from a time certain, but starting from the beginning of life (Arrieta et al., 2018). Getting old is a process natural which means someone has gone through three stages: children, adults, and old. The Elderly is someone who has entered the age of 60 and over. Seniors experience various changes both physical and mental as well as social. Physical changes These include decreased physical strength, stamina, and appearance. This can cause some people to become depressed or feel unhappy when entering the period elderly. They become ineffective in work and social roles if they are dependent on their present physical energy he no

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longer has (Putri, 2021).

Globally, the number of elderly people in the world will continue to improve. Population proportion elderly in the world in 2019 reached 13.4% in 2050 is expected to increase to 25.3% and in 20100 is estimated to be 35.1% of the total population (WHO, 2019). As that happened in the world, Indonesia also experienced population aging In 2019, the number of elderly Indonesia increased to 27.5 million or 10.3%, and 57.0 million people or 17.9% in the year 2045 (Kemenkes, 2019). As we age, age-related changes in the body result in a corresponding decrease in physical activity in daily life. This increases the risk of chronic diseases such as heart disease, arthritis, back pain, neuralgia, high blood pressure, diabetes, and digestive diseases.

Lack of physical activity and lack of exercise are the main causes of health problems in the elderly (Anuar et al., 2021). Therefore, it is very important to develop a prevention plan that incorporates physical movement into daily life. Many health problems experienced by the elderly can be prevented or delayed through a physically active lifestyle. Studies in elderly populations show that regular physical activity can benefit mobility, pain relief, and mental health, as well as increased autonomy and life satisfaction. Despite these known benefits, it is estimated that 50–60% of adults aged over 60 years are not meeting recommended levels of physical activity that is, ≥150 minutes of moderate-intensity aerobic physical activity or 75 minutes of vigorous-intensity aerobic physical activity per week (Roma et al., 2013).

Physical activities such as gymnastics, yoga, elastic bands, and aerobics in the elderly which are carried out routinely can improve physical fitness so that gymnastics can indirectly improve heart function, arterial function in blood flow to heart rate, affect heart rate, and respiration (Welford et al., 2022). Exercise or sports for the elderly must be adjusted individually, for specific purposes, and certain types and intensities can be given. Elderly gymnastics that is low impact, easy to do, not burdensome, and can be applied to the elderly can be used as physical exercise to improve the components of cardiorespiratory fitness, muscle strength, and endurance, as well as flexibility and balanced body composition (Putra, 2019).

METHODS

The study design used in this study was a systematic review and meta-analysis, using PRISMA flow chart guidelines. Article searches were carried out using a journal database that included: PubMed, Science Direct, Google Scholar, and PEDroby selecting articles published in 2012-2022. The keywords used are*("Fitness" OR "Wellness") AND ("Physical Activity" OR "Exercise") AND ("Elderly" OR "Older Adults") AND "randomized controlled trial"*.The inclusion criteria are full articles *paper articles* with the Randomized Controlled Trial (RCT) research method, the relationship measure used with Mean SD, the intervention given was physical exercise, using VO2 Max and six-minute walking test as research instruments, research subjects were elderly > 60 years old, and experienced a decrease in fitness level.

Exclusion criteria in this study include articles published other than English and Indonesian, elderly with comorbidities and progressive, postoperative, and experiencing the process of healing disease. Articles that met the requirements were analyzed using the Revman 5.3 application. Data were analyzed based on variations between studies by determining the use of random effect analysis models. This study uses I^2 to quantify dispersion. The results of the data analysis are in the form of effect size values for the heterogeneity of the study, which will later be interpreted in the form of forest plots and funnel plots.

RESULT AND DISCUSSION

Result

Research from primary studies related to physical exercise for fitness in the elderly contained 5 articles with a total sample of 258 participants, 128 participants for intervention, and 130 participants as comparisons. Search for the article was carried out using a database based on the PRISMA flow chart which can be seen in Figure 1. Assessment of the

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quality of the study was carried out qualitatively and quantitatively. Quality assessment in this study used critical appraisal for a randomized controlled trial (RCT) which consisted of 11 questions answered with yes, no, unclear, and accompanied by comments. After conducting an assessment of the quality of the study, as many as 5 articles included in the meta-analysis quantitative synthesis process were analyzed using RevMan 5.3.

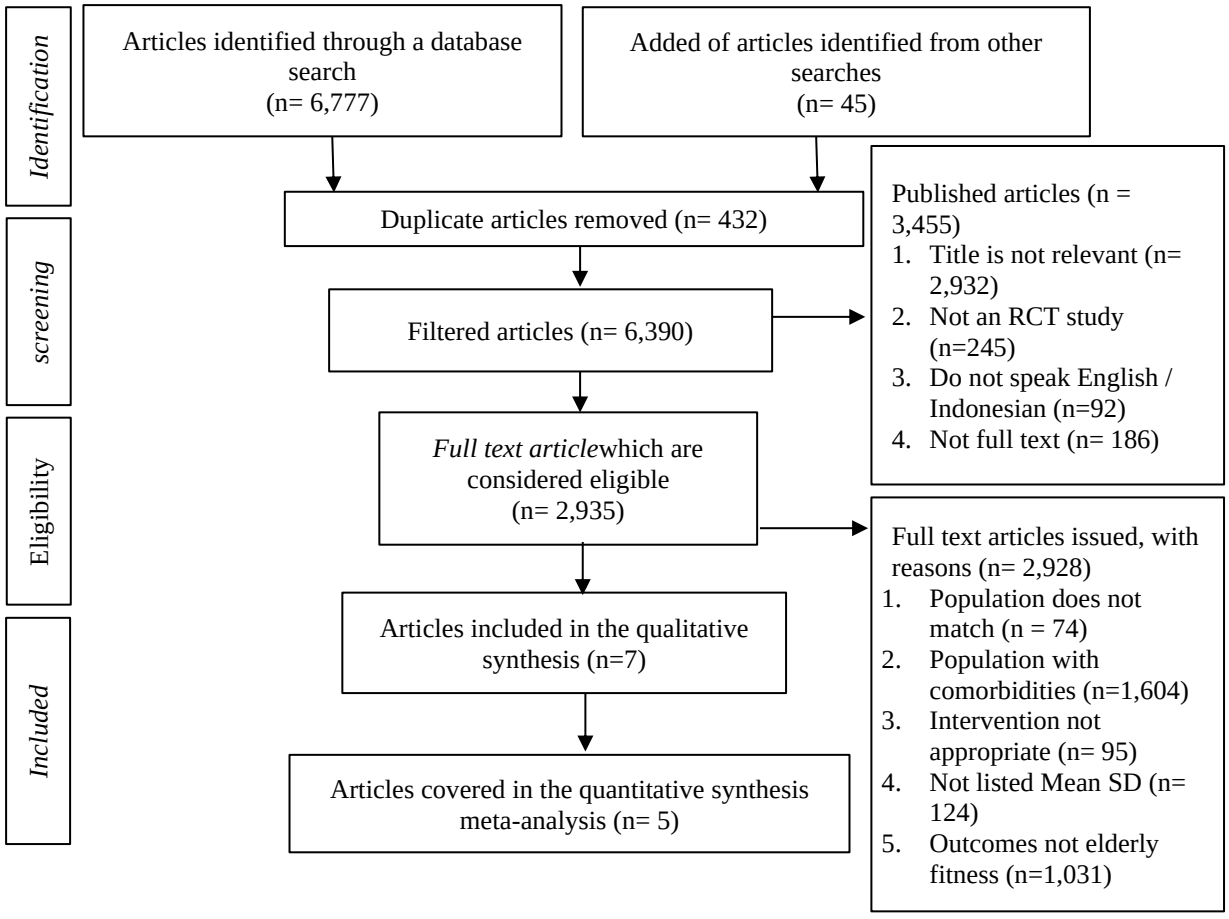

Figure 1. PRISMA flow chart

Forest Plot

Interpretation of the results of the meta-analysis process can be seen through the forest plot. Figure 2 shows as many as 5 articles reporting that physical exercise can improve fitness in the elderly compared to not being given exercise. Meanwhile, there was heterogeneity between experiments with ranged values (I^2=35%;p<0.19). Thus the Fixed Effect Model is used in data analysis in forest plots. Doing physical exercise can increase fitness in the elderly by 0.24 times compared to not being given exercise, but it is not statistically significant (SMD -0.44; 95% CI = -1.06 to 0.18; p = 0.06).

Funnel Plot

Funnel plots a plot that plots the estimated effect size of each study against its estimate of its precision, which is usually the standard error. Figure 3 funnel plot of physical exercise to improve fitness in the elderly, showing that there is a publication bias which is indicated by the asymmetry of the right and left plots where there are 2 plots on the left, 2 plots on the right, and 1 plot in the middle. The plot on the left of the graph has a standard error of 0.2 while the plot on the right has a standard error of 0.4. In addition, there is 1 plot on the right side away from the vertical centerline.

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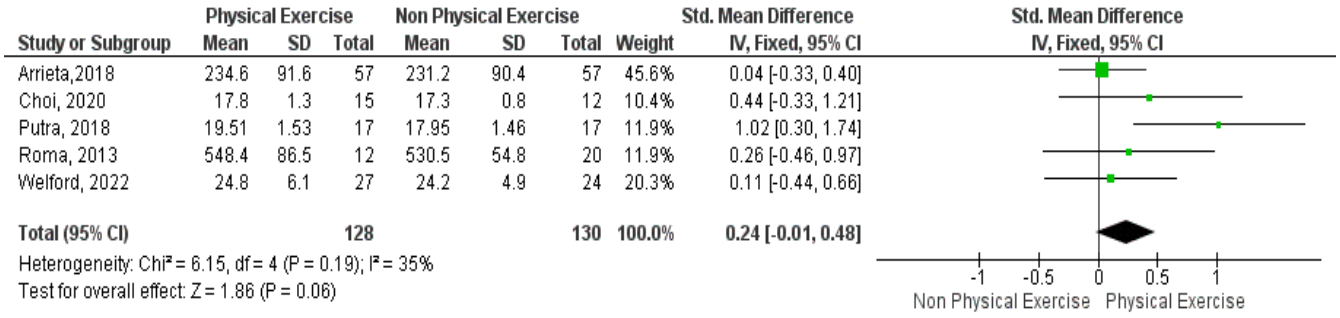

Figure 2. Forest plot Physical exercise to improve fitness in the elderly

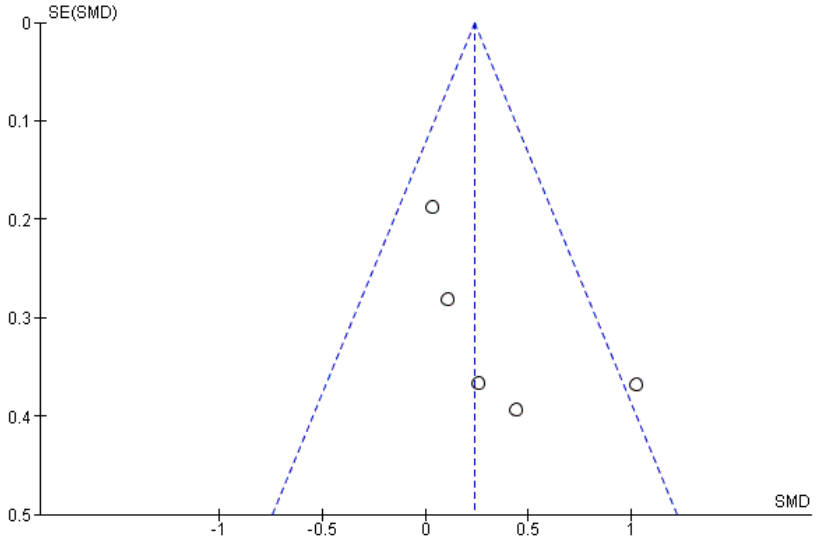

Figure 3. Forest plot Physical exercise to improve fitness in the elderly

Discussion

Physical activity for the elderly is intended to improve physical fitness. Aging is associated with a decline in physical function that affects vital processes that are important for a person's level of independence, social participation, and quality of life. The older a person becomes, the more disability increases in activities of daily life as a result of a decrease in physical level (Choi et al., 2020). The aging process shows physiological, cognitive, and psychological changes in the human body. Decreased fitness components, such as muscle strength, balance, and the cardiorespiratory system can affect the development of disabilities (Roma et al., 2013).

Decreased cardiorespiratory fitness in the elderly is due to several factors, such as biological aging processes, lifestyle changes, development of chronic diseases, drug use, or a combination of these reasons. Typical changes due to the aging process are an increase in maximum heart rate, maximum stroke volume, and maximum cardiac output, as well as a decrease in body mass, an increase in fat mass, and the possibility of changes in capacity muscle oxidation (Widiastuti et al., 2017). Physical exercises such as gymnastics, yoga, elastic bands, and low-impact aerobics can improve fitness to help increase the heart's loading capacity, VO2 Max, cardiac output, and heart volume, reduce myocardial oxygen consumption, and increase overall muscle strength (Putra, 2019).

In this systematic review, there are 5 intervention study articles identified worldwide from 2013 to 2022. This study analyzes the articles using the Mean SD size. The results of the systematic review and meta-

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analysis are presented in the form of forest plots and funnel plots. 5 research articles with randomized controlled trials study design as a source of meta-analysis of physical exercise to improve fitness in the elderly. The results of the forest plot show that physical exercise can increase fitness in the elderly by 0.24 times compared to not being given exercise, but it is not statistically significant (SMD -0.44; 95% CI= -1.06 to 0.18; p=0.06).

The results of this study are in line with research conducted by (Putra, 2019) that there is an effect of providing elderly gymnastics on increasing cardiorespiratory fitness in the elderly. Aerobic exercise including gymnastics can improve VO2 Max by several mechanisms, such as increased perfusion in the muscles due to changes in endothelial dysfunction and increased oxygen saturation in the muscles. The use of oxygen during exercise by skeletal muscles in the elderly is directly related to an increase in overall muscle strength. Changes that occur are increased physical and cardiovascular performance in the elderly. In line with this (Choi et al., 2020) stated from the results of their research that there was an increase significantly in the exercise group, while no significant increase was found in the control group ($P<0.05$). Cardiovascular parameters including systolic blood pressure, diastolic blood pressure, mean arterial pressure, and pulse pressure decreased significantly in the exercise group relative to the control group ($P<0.05$). The findings of this study indicate that a safe, inexpensive, and easily accessible elastic band program with a circuit training component has an important role in improving upper and lower body fitness, as well as cardiovascular fitness, in the elderly.

Research conducted by (Arrieta et al., 2018) states that physical exercise can make better physical fitness and higher levels of physical activity as well as factors associated with better performance. This result is in line with other research which found that the activities carried out outside, the higher their level of physical activity. More and more opportunities may arise for citizens to visit places of personal significance and to interact socially with others. Participants' physical activity can not only improve physical fitness but can also be beneficial for cognitive function. This is confirmed by research (Roma et al., 2013) which stated that the intervention group that was given physical exercise in the form of aerobic exercise showed an increase in physical fitness than the resistance training group. This study showed a statistically significant increase in walking for six minutes in the aerobics group. The six-minute walking test is widely used to evaluate pulmonary rehabilitation and is considered reliable in evaluating functional ability

This research is not in line with previous research, (Welford et al., 2022) stated that the group of elderly who were not physically active but had good fitness were more interested in participating in yoga than doing physical exercise in the form of aerobic exercise. An adapted yoga program (BWY Gentle Years Yoga) was found to be feasible and potentially beneficial for mental and social well-being. These findings, in addition, suggest that the beneficial effects of yoga on well-being may be similar to those of aerobic exercise, but with fewer side effects.

CONCLUSION

The meta-analysis conducted on 5 primary studies concluded that physical exercise alone affected increasing fitness in the elderly by 0.24 times compared to no exercise, however, it was not statistically significant (SMD -0.44; 95% CI = -1.06 to 0.18; p=0.06). This article uses the fixed effect models approach with I^2= 35%.

ACKNOWLEDGEMENT

Researchers would like to thank all those who helped compile this article and also thank the database providers PubMed, Science Direct, Google Scholar and PEDro.

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