



## The Effect of Elderly Gymnastics on Bone Density and Balance in the Elderly at Batara Hati Mulia Foundation

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### ABSTRACT

*Elderly is the process of slowly disappearing the ability of tissues to repair themselves / replace and maintain their normal structure and function so that they cannot survive the traces (including infection) and repair the damage suffered. Problems that are often experienced by the elderly are decreased bone density and balance problems. In every body activity or movement, the body will always need balance both statically and dynamically so that the position of the human body becomes stable and reduces the risk of falling. This study aims to determine the effect of elderly exercise on bone density and balance in the elderly at the Hati Mulia Foundation, Takalar Regency. This study uses a quasi-experimental research design with a pretest-post-test one group design. The research population is the elderly at the Hati Mulia Foundation, Takalar Regency. The number of samples was 30 people who were divided into 2 groups, namely the control group carried out by the Batara Hati Mulia Gowa Foundation and the control group each 15 people by the Batara Hati Mulia Takalar Foundation. This study used bioelectrical impedance analysis (BIA) to measure bone density and Stork Stand Test to measure balance before and after the Elderly exercise treatment for the treatment group, while the control group was not given any intervention.*

**Keywords:** *Elderly Gymnastics; Bone Density; Balance; Elderly.*

### INTRODUCTION

Elderly is the process of slowly disappearing the ability of tissues to repair themselves/ replace and maintain their normal structure and function so that they cannot survive the traces (including infection) and repair the damage suffered. Thus, humans will lose their resistance to infection and will accumulate more and more metabolic and structural distortions referred to as "degenerative diseases" such as hypertension, atherosclerosis, diabetes mellitus and cancer (Darmojo & Martono, 2009).

The development of the elderly population in Indonesia is interesting to observe. From year to year, the number tends to increase. The Office of the Coordinating Ministry for People's Welfare (KESRA) reported that in 2006 the number of elderly people reached 19 million people (8.90%) and life expectancy (UHH) also increased (66.2%), and in 2010 the estimated elderly population Age in Indonesia will reach 23.9 million or 9.77% and UHH around 67.4%. Ten years later or in 2020 it is estimated that the elderly population in Indonesia will reach 28.8 million or 11.35% with a life expectancy of around 71%. Indonesia is a country that is entering the era of an aging structured population because the number of people aged 60 years and over is around 7.18%. In particular, South Sulawesi is an old structured area, because the percentage of elderly people is more than 7%, which is 9.05% (Martono, dan Heru, 2007).

Problems that are often experienced by the elderly are decreased bone density and balance problems. In every body activity or movement, the body will always need balance both statically and dynamically so that the position of the human body becomes stable and reduces the risk of falling. When balance control is disturbed, it will result in the loss of a person's quality of life, such as loss of confidence in activities due to fear of falling, fractures, head injuries and other accidents due to falls. This will reduce the quality of life and increase one's dependence on others (Setiahardja, 2005). Balance disorders can also cause difficulty performing daily activities independently. Balance disorders are divided into two, namely static (when still, for example sitting, standing) and dynamic (when carrying out a purposeful movement or activity). Both are needed as a basis for purposeful mobilization and voluntary movement.

Another problem faced by age is decreased bone density caused by a decrease in low bone mineral density causing osteoporosis, and is a risk factor for fractures including stress fractures (Kim, 2018). According to Khawaja et al (2019) bone density is positively correlated with muscle strength. Physical activity has the most significant effect on bone status in men Kopiczko et al (2020). After 7 months of training, there was a significant increase in Bone Mineral Content (BMC) and Bone Mineral Density (BMD) (de Avila et al., 2019). Exercise promotes remodeling changes by increasing bone formation by bone osteoblasts through direct and indirect effects. Increasing bone formation by osteoblast will increase bone density to avoid early osteoporosis (Lesmana & Broto, 2017).

Based on a preliminary study conducted by researchers in January 2022 at the Hati Mulia Foundation, Takalar Regency, there are elderly people who experience balance

disorders. So this is the reason that underlies researchers to study more deeply related to "The Influence of Elderly Exercise on Bone Density and Balance in the Elderly"

## METHOD

This study is quasi-experimental research that aims to see the effect of elderly exercise on bone density and balance in the elderly at the Hati Mulia Foundation, Takalar Regency. This research was carried out for 4 months with the research population being the elderly at the Hati Mulia Foundation, Takalar Regency. The number of samples in this study were 30 people who were divided into 2 groups, namely the control group carried out at the Batara Hati Mulia Foundation Gowa and the control experimental group at the Batara Hati Mulia Takalar Foundation with 15 samples each. This study uses research such as bioelectrical impedance analysis (BIA) to measure bone density and Stork Stand Test to measure balance.

The data that has been obtained will be analyzed computerized using the SPSS program. First, the normality test was conducted to determine the distribution of the data. If the data is normally distributed, it will be tested using a parametric test in the form of a paired t test followed by an independent test, while if the data is not normally distributed, a non-parametric statistical test is used, namely the Wilcoxon test followed by the Man Whitney test.

## RESULTS

**Table 1.**

Gender distribution of the elderly Hati Mulia Foundation, Gowa Regency and Hati Mulia Foundation, Takalar Regency.

Gender	Gowa Regency		Takalar Regency	
	f	%	f	%
Man	4	26.7	4	26.7
Woman	11	73.3	11	73.3
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>
Age	Gowa Regency		Takalar Regency	
	f	%	f	%
60 - 74 Years	14	93.3	15	100.0
75 - 90 Years	1	6.67	0	0.0
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>

Source: Primary Data. 2022

Table 1. shows that the gender of the elderly in the Hati Mulia Foundation, Gowa Regency are 4 men (26.7%) and 11 women (73.3%), for the Hati Mulia Foundation, Takalar Regency, there were 4 men (26.7%) and 11 women (73.3%). The distribution of

respondents by age shows that for Gowa Regency as many as 14 people (93.3%) are aged 60-74 years while for Takalar Regency 15 people (100%).

**Table 2.**  
 Bone Density

Bone Density	Takalar Regency				Gowa Regency			
	Pre Test		Post Test		Pre Test		Post Test	
	n	%	n	%	n	%	n	%
Normal	3	20.0	3	20.0	5	33.3	5	33.3
Osteopenia	12	80.0	12	80.0	10	66.7	10	66.7
Osteoporosis	0	0.0	0	0.0	0	0.0	0	0.0
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>

Source: Primary Data. 2022

Table 2. shows that the bone density of the elderly for the treatment group (Takalar Regency) there are 3 people (20.0%) normal 12 people (80.0%) osteopenia. In the post test there were 3 people (20.0%) normal 12 people (80.0%) osteopenia. For the control group (Gowa Regency), in the pre test there were 5 people (33.3%) normal, 10 people (66.7%) osteopenia. In the post test there were 5 people (33.3%) normal, 10 people (66.7%) osteopenia.

**Table 3.**

The balance of the treatment group (Takalar Regency) and the Control Group (Gowa Regency)

Balance	Takalar Regency				Gowa Regency			
	Pre Test		Post Test		Pre Test		Post Test	
	n	%	n	%	n	%	n	%
Advanced	0	0.0	0	0.0	0	0.0	0	0.0
Advanced Intermediate	0	0.0	0	0.0	0	0.0	0	0.0
Intermediate	8	53.3	12	80.0	5	33.3	6	40.0
Advance beginner	7	46.7	3	20.0	10	66.7	9	60.0
Beginner	0	0.0	0	0.0	0	0.0	0	0.0
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>

Source: Primary Data. 2022

Table 3. shows that the pre-test balance of the treatment group (Kab Takalar) was 8 people (53.3%) intermediate. and 7 people (46.7%) advanced beginners. In the post test, there were 12 people (80.0%) intermediate and 3 people (20.0%) advanced beginner. The pre-test balance of the control group (Kab Gowa) consisted of 5 people (33.3%) intermediate and 10 people (66.6%) advanced beginner. In the post test, 6 people (40.0%) intermediate and 9 people (60.0%) advanced beginners.

**Table 4.**

Wilcoxon test results on bone density variables in the treatment group and control group

Pre-test and post-test scores	n	mean	SD	$\alpha$
Bone density before the elderly exercise intervention	15	-1,706	0,487	0,005
Bone density after elderly exercise intervention	15	-1,466	0,811	
Bone density pre test control group	15	-1,25	-1,80	0,059
Bone density post test control group	15	-1,22	-1,60	

Description: \* Wilcoxon test

Based on table 4. it can be explained that giving elderly exercise can significantly increase bone density with a value of  $< 0.05$  from -1.706 to -1.466. This shows that  $H_0$  is rejected, meaning that there is an effect of elderly exercise on the bone density of the elderly. In the control group, there was no change in bone density between pre-test and post-test.

**Table 5.**

Wilcoxon test results on balance variables in the treatment group and control group

Pre-test and post-test scores	n	mean	SD	$\alpha$
Balance before the elderly exercise intervention	15	9,93	4,48	0,002
Balance after the elderly exercise intervention	15	12,47	5,66	
Control group pre test balance	15	9,07	6,87	0,672
Control group post test balance	15	8,93	6,08	

Description: \* Wilcoxon test

Based on table 5. it can be explained that giving elderly exercise can significantly improve the balance of the elderly with a value of  $< 0.05$  from 9.93 to 12.47. In the control group there was no significant change with  $p$  value = 0.672 between pre test (9.07) and post test (8.93). This shows that  $H_0$  is rejected, meaning that there is an influence of elderly exercise on the balance of the elderly. In the control group, there was no change in the balance between pre-test and post-test.

**Table 6.**

Comparative analysis of bone density values in the treatment group and the control group

Measurement	Mean	SD	$\alpha$
The difference between pre-test and post-test bone density in the treatment group	0,24	0,498	0,026
The difference between pre-test and post-test bone density in the control group	0,33	0,061	

Desc: \* Man whitney test

Based on table 6. shows the results of the Mann Whitney test for testing the hypothesis of the difference in pain between the treatment group and the control group

with a p value of 0.026. This shows that H0 is rejected, meaning that there is a difference in influence between the treatment group and the control group.

**Table 7.**

Comparative analysis of the balance value of the treatment group and the control group

Measurement	Mean	SD	$\alpha$
The difference between the pretest and posttest balance of the treatment group	2,53	2,326	0,001
The difference between the pretest and posttest balance of the control group	-0,13	1,356	

Desc: \* Man whitney test

Based on table 7. shows the results of the Mann Whitney test for hypothesis testing of the difference in pain value between the treatment group and the control group with p value = 0.001. This shows that H0 is rejected, meaning that there is a difference in influence between the treatment group and the control group.

## DISCUSSION

Elderly exercise has a significant effect on balance through the Wilcoxon test with p value = 0.000. This study shows that there is a significant increase in balance. This research was conducted on the elderly at the Hati Mulia Foundation, Takalar Regency (the treatment group) and the Hati Mulia Foundation in the Gowa Regency (the control group).

Several studies explain that physical activity is one of the factors that can increase bone mass. Physical activity such as sports will put stress and pressure on the bones. As a result, the rate of bone deposition will increase. resulting in an increase in bone mass (Sherwood. 2012). According to a study from the American College of Sports Medicine (ACSM). Zumba exercise that is done regularly can have a positive impact on body composition (Luetngen et al.. 2012).

A review of studies on the effects of exercise programs on bone density conducted by Nazari et al (2022) showed that regular physical exercise with different patterns had a beneficial effect on bone density in human and animal models. This study is in line with Nababan's (2021) research which states that there is a significant effect on osteoporosis exercise on bone density in the elderly in Siborongborong District, North Tapanuli Regency. with the results of 8,190 with a significant level of p = 0.005.

This study is inconsistent with with research conducted by Askvik (2010) which stated that none of the types of exercise (resistance training: weight-bearing exercises: osteoporosis-specific exercises; and balance training) showed an increase in BMD in

elderly women with low bone mass.

Elderly exercise has a significant effect on balance through the Wilcoxon test with  $p$  value = 0.000. This study shows that there is a significant increase in balance. This research was conducted on the elderly at the Hati Mulia Foundation, Takalar Regency (the treatment group) and the Hati Mulia Foundation in the Gowa Regency (the control group).

According to Jacobson et al (1997) "The balance is influenced by 3 factors. including: areas of focus. center of gravity and body line. The support plane is the base on which the body rests or stands. good on the floor. soil. chair. table. rope or other place. Place the center of gravity of the body. The center of gravity of the human body is approximately as high as the upper third of the sacrum. if the body is in an upright standing position (anatomical standing). The lower or closer the center of gravity of the body to the plane of support. will be more stable or stable body position (Jacobson et al.. 1997). Position the body line. The line of weight of the body is a vertical line that passes through the center of the support plane. This line of body weight is often called the line of gravity. an imaginary vertical (perpendicular) line through the center of gravity of the body. The closer the line of weight of the body is to the center of the fulcrum. moreover, through it will be more stable body position. In a standing position. The line of weight of the body will pass through the center of gravity of the body and also the center of the fulcrum. Therefore, standing upright is more stable than leaning forward. back or side (Jacobson et al.. 1997). In addition to the above factors. Balance can also be affected by other factors such as muscle strength. muscle endurance. These factors can be improved by elderly exercise. Elderly exercise can increase muscle strength. and muscle endurance. in the elderly

This study is coinciding with the research of Kusumadewi et al (2021) which states that elderly exercise improves the functional balance of the elderly. This research is also in line with Albert's (2019) research which states that elderly exercise can increase the balance score of the elderly. and Laksana's research (2018) which states that there is an effect of elderly exercise on body balance in the elderly at the Posyandu, Janggan Village, Poncol District, Magetan Regency.

## CONCLUSIONS AND SUGGESTIONS

Based on the results of the study, it can be concluded that there is an effect of elderly exercise on bone density in the elderly and there is also an effect of elderly exercise on balance in the elderly, especially at the Hati Mulia Foundation, Takalar Regency.

Suggestions for physiotherapists to apply elderly exercise which aims to increase bone density and balance in the elderly. In addition, it is recommended for further researchers. to conduct research with a larger number of samples so that the results obtained are better and choose respondents who are more controllable so that the results obtained are more real.

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