

## The Effect of Exercises and Gender on Cardiorespiratory Endurance in the Elderly

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### Abstract

One of the appropriate sports for the elderly is elderly exercises. The exercises require low-impact movement but still can stimulate heart-lungs work, so it is suitable for the condition of the elderly. This study aims to analyze the effect of exercises and gender on cardiorespiratory endurance. This experimental research employed a 2x2 factorial design. There were 20 older adults from *Keluarga Harapan* Program selected as the sample, and the technique of data collection was purposive sampling. Subsequently, the sample was divided into four experimental groups. The technique of data analysis employed Two Way Anova. The results of the study are, first: *Sang Surya* and *Lansia Bugar* exercises affect the cardiorespiratory endurance ( $F_{\text{value}} = 17.308 > F_{\text{table}} = 3.59$ ). *Lansia Bugar* exercise is better than *Sang Surya* exercise. Secondly, there is an effect of gender between male and female on the cardiorespiratory endurance ( $F_{\text{value}} = 56.077 > F_{\text{table}} = 3.59$ ). Male older adults affected cardiorespiratory endurance more than the female. Thirdly, there is an interaction of exercises and gender on the cardiorespiratory endurance ( $F_{\text{value}} = 22.231 > F_{\text{table}} = 3.59$ ). The conclusion of this study is exercises and gender affect cardiorespiratory endurance so that they can maintain the health and fitness of older adults.

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## INTRODUCTION

The elderly are an indicator of development success, which is shown by the decrease in death rate, so life expectancy increases. The increase in life expectancy contributes to the elderly population rise, which also becomes a factor of national welfare improvement. If the increase in the elderly population is not in line with providing efforts to maintain their health, the elderly health will be decreasing or getting worse as well as being a family burden. The rising in life expectancy is becoming a crucial problem which can affect not only health but also long-term life quality (Young, 2008; Crawford, and Walker, 2009).

The above problem can be prevented by changing lifestyle, from a passive lifestyle to the active one, for example, by doing physical exercises or sports in an appropriate, correct, regular, and measured way. McAuley, and Rudolph (1995) stated there were quite shreds of evidence that sports provided different psychological effects on men and women or individuals with different ages.

Burke (2001) elaborated that 70% of disease is correlated to lifestyle. During the past decade, several studies reported that long-term regular exercise and an appropriate diet could solve health problems, including heart problems, diabetes, osteoporosis, and several types of cancer, as well as preventing obesity.

There are various types of sports that people do, for example, leisurely strolling, jogging, bicycling, and doing exercises. People usually do exercises in studios, fields, and government institutions.

Exercises are widely created by competent institutions or organizations which are concerned with elderly development. A variety of movement can be implemented to the elderly easily as it fits the physical condition of the elderly. Elderly exercise is a series of organized and purposeful body movement which elderly people do to enhance their body to function well (Palgunadi, Rahayu, and Subiyono, 2014).

The wide variety of exercises provides a good impact on one hand, but as there are several

options for people to follow an exercise they are interested in. On the other hand, guidance for people in doing exercise is required because injury and death often occur during exercises. It must be anticipated, as mentioned by Taylor, P. M., and Taylor, D. K. (2002) "aerobic exercises have rapidly developed, and running as well, which are more popular than before. However, the popularity of exercise and running is followed by an increase in injury and death case." In particular, people who are adult and elderly considering their age are vulnerable suffer injury, faint, and even die.

They are doing sports need skills. Skills can be defined as the mastery level. The mastery of a motor skill is a process when an individual is developing a set of response to a movement pattern which is coordinated, organized, and integrated (Sulaiman, 2014).

When an individual is getting older, her/his body naturally will degenerate. In this condition, the case is how she/he still can do useful activities. Besides improving physical fitness, physical activities can also strengthen the balance of mental, emotional, and social of the elderly. Live healthily in the elderly age is a solution which can be done by the elderly to enhance the meaning of life in the old time (Junaidi, 2011).

According to Bandiyah (2009) the decrease in physiology and anatomy functions in the elderly can be seen from the motor, sensory, and sensorimotor functions. Motor function is related to the decrease in bone strength, muscle, and joint that will affect flexibility, strength, speed, instability (easily fall) and body stiffness, including difficulty to get up from sitting or vice versa, squatting, moving, and walking. Sensory function affects sensory sensitivity, including the vision and touching sense that result in loss of feeling when stimulated (anesthesia), over feeling when stimulated (hyperesthesia) and improper feeling (paraesthesia). The decrease in sensorimotor function can be in the forms of balance and coordination disorders (Sudrajat, and Sutardji, 2014).

Physical abilities or physical fitness is a condition of physical abilities that can adjust the

functions of body organs with particular physical tasks and with the environment condition efficiently, without feeling exhausted, and get recovered before the same task the next day (Giriwijoyo, 2007).

People with less physical activities tend to have low physical fitness. People with low physical fitness will burden their welfare as their attempt or work will get disturbed (Purwanto, 2011).

The low physical fitness caused by low health quality and less-movement lifestyle is associated with low work productivity, which results in the low Human Development Index (HDI). Based on the report by UNDP (United Nations Development Programme) 2014, Indonesia ranked 119<sup>th</sup> out of 125 nations. HDI is an indicator of national success in developing human resources which are determined by health, education, and income factors.

Cardiorespiratory endurance is the most vital component of physical fitness (Department of Health, 1999). Cardiorespiratory endurance is the lungs, cardio, and blood vessel abilities to provide an adequate amount of oxygen in cells to meet the continuous demands of physical activities. (Hoeger, W., and Hoeger, S., 2014).

High cardiorespiratory endurance also indicates a high ability to work, meaning the ability to produce a quite great amount of energy in an extended period. Cardiorespiratory endurance is influenced by several factors, including genetics, age, gender, physical activities, smoking habit, and nutrition (Sharkey, 2003).

A procedure to evaluate cardiorespiratory endurance is by measuring VO<sub>2</sub>max value. VO<sub>2</sub>max measures the capacity of heart, lungs, and blood to transport oxygen to the working muscles and measures the use of oxygen by muscles during exercises (Nugraheni, Marijo, and Indraswari, 2017).

Cardiorespiratory endurance is a process of using and providing oxygen for muscle work in a long period, affected by several factors such as age, gender, physical activities, sports habits, body mass index, nutrition, hemoglobin level,

stress level, and smoking habit (Pertiwi, Muis, and Suroto, 2018).

It was found that endurance exercises for older adults resulted in the high improvement of VO<sub>2</sub> maks, similar to the younger people (Ahmaidi, Masse-Biron, Adam, Choquet, Freville, Libert, and Prefaut, 1998)

However, to maintain the health of the elderly, it is necessary to prevent them from doing exercise beyond their body limit. The suggested exercises for the elderly are exercises that involve movement to train respiratory and cardio, train muscle strength, joint strength, recreational, and do not boring for the elderly (Pribadi, 2015).

Healthy sports for the elderly is an important issue to program, from healthcare workers, sports professionals, and society. The cardiovascular system is a system facilitating the process of transporting various substances from and to body cells. Exercises will affect significantly or shortly to the body, including the muscle system, hormonal system, blood circulation system, respiratory system, digestive system, metabolism, and exhaust system (Kurnianto, 2015).

Following the above elaboration, the research intends to investigate further “The Effect of Exercises (*Sang Surya* and *Lansia Bugar*) and Gender (Male and Female) on Cardiorespiratory Endurance in Elderly Participating in *Keluarga Harapan* Program in Sumber Jatipohon Villager.”

## METHODS

This study employed an experimental method with a quantitative approach and 2x2 factorial research design.

**Table 1.** Research Design

Exercise (A) Gender (B)	<i>Sang Surya</i> exercise (A <sub>1</sub> )	<i>Lansia Bugar</i> exercise (A <sub>2</sub> )
Male (B <sub>1</sub> )	A <sub>1</sub> B <sub>1</sub>	A <sub>2</sub> B <sub>1</sub>
Female (B <sub>2</sub> )	A <sub>1</sub> B <sub>2</sub>	A <sub>2</sub> B <sub>2</sub>

Information:

A<sub>1</sub> : *Sang Surya* exercise

A<sub>2</sub> : *Bugar Lansia* exercise

B<sub>1</sub> : Male

B<sub>2</sub> : Female

A<sub>1</sub>B<sub>1</sub> : *Sang Surya* exercise for a male group

A<sub>2</sub>B<sub>1</sub> : *Bugar Lansia* exercise for a male group

A<sub>1</sub>B<sub>2</sub> : *Sang Surya* exercise for female group

A<sub>2</sub>B<sub>2</sub> : *Bugar Lansia* exercise for female group

The sampling technique was purposive sampling; the number of samples was 20 people. Hence, each independent variable consisted of ten males and ten females. Each group was divided into two. From the male group, five males were in *Sang Surya* exercise while the other five were in *Lansia Bugar* exercise. It was similar to the female group. Five females were in *Sang Surya* exercise while the other five were in *Lansia Bugar* exercise.

Selecting the sample was by matching. First, the pre-test result was processed and ranked from 1 to 10 of the two groups. Subsequently, in males with rank 1, 4, 5, 8, nine were grouped in *Sang Surya* exercise (A<sub>1</sub>B<sub>1</sub>), males rank 2, 3, 6, 7, ten were grouped in *Lansia Bugar* exercise (A<sub>2</sub>B<sub>1</sub>). Females with rank 1, 4, 5, 8, nine were grouped in *Sang Surya* exercise (A<sub>1</sub>B<sub>1</sub>), males rank 2, 3, 6, 7, ten were grouped in *Lansia Bugar* exercise (A<sub>2</sub>B<sub>2</sub>).

## RESULTS AND DISCUSSION

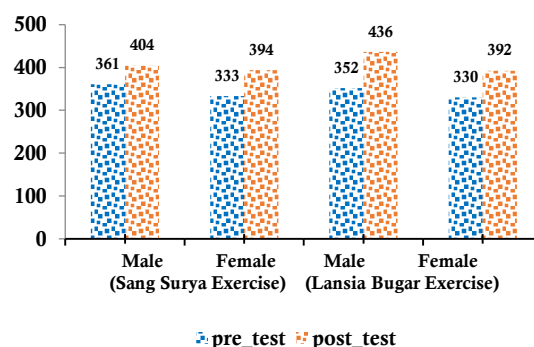
**Table 2.** Pre-Test and Post-Test Data of Cardiorespiratory Endurance of Elderly Joining Keluarga Harapan Program in Jatipohon Village

Exercise	Gender	Data source	Statistics	
			Average	Total
Sang Surya (A <sub>1</sub> )	Male (B <sub>1</sub> )	Pre-test	72.2	361
		Post-test	80.8	404
		Difference	8.6	43
	Female (B <sub>2</sub> )	Pre-test	66.6	333
		Post-test	78.8	394
		Difference	12.2	61
Lansia Bugar (A <sub>2</sub> )	Male (B <sub>1</sub> )	Pre-test	70.4	352
		Post-test	87.2	436
		Difference	16.8	84
	Female (B <sub>2</sub> )	Pre-test	66	330
		Post-test	78.4	392
		Difference	12.4	62

Things that become the concerns of values in table 3 are:

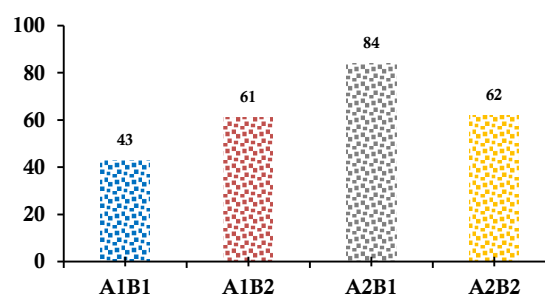
1. The elderly male group doing *Sang Surya* exercise obtained pre-test value 361 and post-test 404 with the difference of 43. Meanwhile, the group doing *Lansia Bugar* exercise gained pre-test value 352 and post-test 436 with the enhancement 84. If compared, it can be concluded that the group doing *Lansia Bugar* Exercise was better than the group doing *Sang Surya* Exercise.

2. The elderly male group doing *Lansia Bugar* obtained pre-test value 352 and post-test value 436 with the improvement 84. Meanwhile, the elderly female group doing *Lansia Bugar* obtained pre-test value 390 and post-test value 392 with the improvement 62. If compared, it can be concluded that the group doing *Lansia Bugar* Exercise was better than the group doing *Sang Surya* Exercise in terms of cardiorespiratory endurance.



**Figure 1.** Bar Chart of Pre-Test and Post-Test

3. To make the enhancement value of cardiorespiratory endurance from each group easy to understand, it is necessary to present the enhancement value of cardiorespiratory endurance in the form of figure 2 as follows:



**Figure 2.** Diagram of Enhancement Value of Cardiorespiratory Endurance in Each Group

To check the data normality, the normal distribution of data was analyzed. The data normality test in this study employed Kolmogorov-Smirnov using SPSS 21. It was stated that the data was normally distributed if the significance value > 0.05. The result of the normality test was normally distributed since the significance value was greater than 0.05.

Data homogeneity test of this study was conducted by employing the Levene test with the help of SPSS 21 with the significance level of 0.05. The Levene significance level was greater than 0.05 (Sig > 0.05); hence, the sample was homogeneous. The result of the homogeneity test can be seen in table 3.

The homogeneity test in this study was conducted using the Levene test. Homogeneity test intends to test the similarity of variance among sample groups.

**Table 3.** Test of Homogeneity of Variances  
Cardiorespiratory

Levene statistic	df <sub>1</sub>	df <sub>2</sub>	Sig.
1.676	3	16	.212

The homogeneity test showed that the significance value was greater than 0.05 (Sig 0.212 > 0.05). Therefore, it can be concluded that the data of cardiorespiratory endurance of each group has homogeneous population variance.

After conducting normality and homogeneity tests, the use of Anova in the data analysis can be done by using SPSS 21. Data of the last test was analyzed through Two Way Anova statistics, and there was hypothesis testing with F-test at significance level 0.05%, and the prerequisite test was conducted in advance.

The hypothesis testing was conducted based on the result of data analysis and the interaction of variance analysis. To investigate the difference, Anova test was required. The Anova summary showed significant differences.

**Table 4.** Anova Summary of Two Factors

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	248.600 <sup>a</sup>	3	82.867	31.872	.000
Intercept	132193.800	1	132193.800	50843.769	.000
Exercise	45.000	1	45.000	17.308	.001
Gender	145.800	1	145.800	56.077	.000
Exercise * Gender	57.800	1	57.800	22.231	.000
Error	41.600	16	2.600		
Total	132484.000	20			
Corrected total	290.200	19			

<sup>a</sup> R squared = .857 (Adjusted R squared = .830)

Based on the result of data analysis in table 4, hypothesis testing can be conducted as follows:

**Table 5.** Estimated Marginal Mean of Exercises and Cardiorespiratory

Exercises	Mean	Std. error	95% Confidence interval	
			Lower	Upper
Sang surya exercise	79.800	.510	78.719	80.881
Lansia bugar exercise	82.800	.510	81.719	83.881

The first hypothesis stated that there was a difference of *Sang Surya* Exercise and *Lansia Bugar* Exercise effects on cardiorespiratory endurance of the elderly joining *Keluarga Harapan* Program in Sumber Jatipohon Village, tested by using Anova test, obtaining  $F_{\text{value}} = 17.309$  with significance level 0.001. The result of this calculation was then consulted to  $F_{\text{table}}$  with  $dk_{\text{numerator}} = 1 (b-1)$  and  $dk_{\text{denominator}} (kb(n-2))$ , with significance level 0.05 obtained  $F_{\text{table}} = 3.59$ . Since the calculated  $F_{\text{value}} > F_{\text{table}}$  or  $17.309 > 3.59$ , with significance level  $0.001 < 0.05$  then  $H_a$  : “there was a difference of *Sang Surya* Exercise and

*Lansia Bugar* Exercise effects on cardiorespiratory endurance of the elderly joining *Keluarga Harapan* Program in Sumber Jatipohon Village” was accepted. Movement in *Lansia Bugar* exercise is supposed to enhance the fitness components of cardio-respiratory, muscle strength and endurance, flexibility, and balanced body composition (Suhardo, 2001).

Considering the improvement means, *Lansia Bugar* exercise provides a better effect on improving cardiorespiratory endurance than *Sang Surya* exercise.

**Table 6.** Estimated Marginal Mean of Gender.

Gender	Mean	Std. error	95% Confidence interval	
			Lower	Upper
Male	84.000	.510	82.919	85.081
Female	78.200	.510	77.519	79.681

The second hypothesis stating that there was a difference of gender effect on cardiorespiratory endurance of the elderly was tested by using Anova test and obtained  $F_{\text{value}} = 56.077$  at significance level 0.000. This result was consulted to  $F_{\text{table}}$  with  $dk_{\text{numerator}} = 1$  (b-1) and

$dk_{\text{denominator}} (kb(n-1))$ , with significance level 0.005 obtaining  $F_{\text{table}} = 3.59$ . Since the calculated  $F_{\text{value}} > F_{\text{table}}$  or  $56.077 > 3.59$  with significance level  $0.000 < 0.05$  then  $H_a$  stating “there was a difference of gender effect on cardiorespiratory endurance of the elderly participating in *Keluarga Harapan* program in Sumber Jatipohon Village” was accepted.

Therefore, considering the average enhancement value, the male elderly affected cardiorespiratory endurance more than the female elderly.

**Table 7.** Estimated Marginal Mean of Exercise and Gender Interaction on Cardiorespiratory Endurance

Exercises	Gender	Mean	Std. error	95% Confidence interval	
				Lower	Upper
Sang surya exercise	Male	80.800	.721	79.2	82.3
	Female	78.800	.721	77.2	80.3
Lansia bugar exercise	Male	87.200	.721	85.6	88.7
	Female	78.400	.721	76.8	79.9

There was an interaction of exercises and gender on cardiorespiratory endurance in the elderly participating in *Keluarga Harapan* Program by using Anova test,  $F_{\text{value}} = 22.231$  with significance level 0.000. This result was then consulted with  $F_{\text{table}}$  with  $dk_{\text{numerator}} = 1$  (b-1) and  $dk_{\text{denominator}} (kb(n-1))$ , with significance level 0.05 obtaining  $F_{\text{table}} = 3.59$ . Since the calculated  $F_{\text{value}} = 22.231 > F_{\text{table}} = 3.59$  with the significance level  $0.000 < 0.05$ , then  $H_a$  stating that “there was an interaction of exercises and gender on cardiorespiratory endurance in the elderly participating in *Keluarga Harapan* in Sumber Jatipohon Village” was accepted.

## CONCLUSION

The conclusion of this study is there is a difference in the effect of *Sang Surya* exercise and *Lansia Bugar* exercise on the cardiorespiratory endurance of the elderly participating in *Keluarga Harapan* Program Sumber Jatipohon Village. There is a difference in the effect of male elderly and female elderly on the cardiorespiratory endurance of the elderly participating in *Keluarga Harapan* Program Sumber Jatipohon Village. There is an interaction of exercises and gender on the cardiorespiratory endurance of the elderly

participating in *Keluarga Harapan* Program Sumber Jatipohon Village. This study indicates that the implementation of *Sang Surya* and *Lansia Bugar* exercise can enhance cardiovascular endurance; hence, it affects the physical fitness of the elderly.

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