

Mirror Therapy Improved Muscle Strength of the Elderly

1st Sri Jati Permata Putri
*Applied Undergraduate Nursing and
Nurs Profession Program, Nursing
Major*
*Health Polytechnic of Ministry of
Health Semarang*
Semarang, Indonesia
jatiputri08@gmail.com

2nd Muhamad Jauhar
*Community Health Nursing
Department, Nursing Major*
*Health Polytechnic of Ministry of
Health Semarang*
Semarang, Indonesia
muhamadjauhar@poltekkes-smg.ac.id

3rd Budi Widiyanto
*Community Health Nursing
Department, Nursing Major*
*Health Polytechnic of Ministry of
Health Semarang*
Semarang, Indonesia
widiyanto.budi@gmail.com

Abstract—Everyone will face the aging process. The elderly's problems are physical mobility and physiology causing a decrease on their muscle strength. Mirror therapy is one of nursing interventions that can improve muscle strength. This study aimed to identify the influence of mirror therapy on muscle strength in elderly in Boyolali regency. A quasi-experimental design with a pre post-test nonequivalent control group was used in this study. The study sample were elderly who decrease in physiological's muscle strength of 56 people . The sample were divided into intervention and control groups using purposive sampling technique. The instrument used is the *Manual Muscle Testing* (MMT) scale. Interventions are given twice a day for 10-15 minutes in 3 weeks. Data analysis performed by using the Wilcoxon test and Mann Whitney test. The results showed that there was a significant effect of mirror therapy in improving muscle strength of the elderly with a mean difference of 1.32 and p value = 0.001 (<0.05). Mirror therapy as an innovative nursing intervention can significantly improve muscle strength, so that it can be integrated into the elderly health service program at the primary health care services.

Keywords: *elderly, mirror therapy, muscle strength*

I. INTRODUCTION

Life expectancy steadily increases as a phenomenon both nationally and globally. This palpable phenomenon caused an increasing number of elderly and decreasing number of productive ages as the results. Declining number of the productive ages affected the elderly's social and economical burden of which family, community and also nation should be responsible [1]. Aging process will

surely happens in every individual, starting with a declining function of tissue in restoring and maintaining the normal state and resulting in the higher chance of health problems both infection and degenerative cases in the elderly. The worsening of the normal state of elderly will also cause the declining ability to move from one place to another. Physiologically, this mobilization difficulties might affect the protein metabolism and resulting in more serious problem as weakening muscle strength and affecting general ability to do their daily activities independently.

World Population Prospect datas of 2017 showed that elderly (60 year old and over) number was about 12% of the total global population of 2015 [2]. World Health Organization (WHO) in 2013 also stated that there were 24,7 millions elderly population or about 9,3% of the total Indonesia population [3]. Central Java Province placed second as the highest number of elderly population (12,59%) back in 2016 after Special Area Yogyakarta Province (13,81%) and East Java Province (12,25%) [4]. As many as 487.989 elderly (9,08%) live in Boyolali Regency, which 5,6% of them living in the Boyolali District. There was a steady increase of the elderly population as 1,3% per year with the most contributive health problem was stroke [5].

The phenomenon of the increasing number of elderly in both global and naional level was also followed by the increasing number of the health problems caused by the aging process. One of the health problem in the elderly was a declining muscle strength of 10-15% every week or 5,5% per day if the muscle didn't performed their daily function [1]. Muscle function depletion might causes inability to performed daily activities, increase risk of fall and injury of the elderly. For this matter, physical acitivities are needed to keep the muscle strength and prevent falls in the elderly. A background study were

conducted, prior to the intervention, and found that the majority of elderly who visited Puskesmas (Public Health Centre) Boyolali I have motion difficulties caused by stroke resulting of limitation in performing their daily activities. Promotive and preventive intervention should be conducted to prevent further complication of this worsening muscle strength in elderly as in falls and injury [4].

The background study in the working area of Puskesmas I Boyolali identified several programs that have been performed as the promotive and preventive intervention to address the problem, one of the program is elderly gymnastics This routine was performed regularly in Posyandu Lansia (a comprehensive health post of the elderly in every village) however, there were several problems as the limitation of the instructors, difficult access to the Posyandu Lansia that cause the elderly took quiet some times reaching the destined place so that they have to left their house chores or jobs. These matters caused some of the elderly contemplating to participate in the Senam Lansia routine. Mirror therapy addressing this issue by providing a simple routine that can be performed independently at home.

Mirror therapy is one of the physical activities related to the mobilization focussing on the unaffected extremities' movement using mirror to deliver the visual stimulation by observing the instructor's movement. The movement series of this activities consist of fingers' extention-flexion, also making and releasing a fist [6]. Several studies have been done, one of them was by [7], [8], [9] in stroke patients, [10] in adult patients, lastly by [11] in post-stroke patients. The studies stated that mirror therapy significantly increase movement ability of the extremities. The difference between this study and the previous studies is that the research subjects are the elderly and using control group. Based on the matters and previous studies, this study developed nursing intervention that not only can address muscle strength problem of the elderly but also provide support to the family as the main caregiver. The nurses as a educator, care giver, advocator, counselor, collaborator, and researcher for this case. Mirror therapy as a one of innovative nursing intervention can be alternative solution to improve elderly's muscle strenght.

II. METHOD

This study was quasi-experiment using *pretest and posttest with control group* [12]. The respondents of this study were elderly with decreasing physiological muscle strength in upper extremities who were chosen by *purposive sampling* [12]. The inclusion criteria of the respondents included having a decreasing muscle strength

on the upper extremities based on MMT score, aged 60-74, no visual impairment , and have a complete of upper extremities. The movement series of this activities consist of fingers' extention-flexion, also making and releasing a fist. Sample size was measured by *Lameshow* formula resulting of 28 elderly in each intervention and control group. The therapy was performed during 3 weeks consist of 2 part for 10-15 minutes per part and break in 5 minutes once. . *Manual Muscle Testing* (MMT) developed by Kozier (2008) was used to measure the muscle strength. Univariate analysis showed in frequency and percentage (categorical datas) and numerical datas showed in mean and SD. Normality test used *Kolmogorov-smirnov*, and then *Wilcoxon* and *Mann Whitney* for bivariate analysis [12]. The study has ethical approval from the Health and Medicine Research Ethics Committee of the Faculty of Medicine at the Sultan Agung Islamic University (251/V/2019/Komisi Bioetik).

III. RESULT

The demographic characteristics of the elderly in the intervention and control groups are presented in tables 1 and 2. Half number of the elderly graduated from junior high school (intervention group) and 37.5% graduated high school (control group). Most of the elderly did not work in the intervention (46.4%) and control (35.7%) groups. Most of the elderly did not have income in the intervention (70%) and control (46.7%) groups. The average age of 65.3 years. Number of men and women in the intervention and control group are similar (50.0%).

TABLE 1. THE CHARACTERISTICS OF THE ELDERLY BASED ON GENDER, EDUCATION, OCCUPATION (N=56)

Characteristics	Intervention		Control	
	f	%	f	%
Sex				
Male	14	50.0	14	50.0
Female	14	50.0	14	50.0
Education				
Elementary School	6	21.4	8	28.6
Junior-high School	14	50.0	6	21.4
High School	6	21.4	10	35.7
University	2	7.1	4	14.3
Occupation				
Civil Servants	4	14.3	4	14.3
Entrepreneurs	6	21.4	7	25.0
Private Employees	3	10.7	5	17.9
Retired	2	7.1	2	7.1
Not Working	13	46.4	10	35.7

TABLE 2. THE CHARACTERISTICS OF THE ELDERLY BASED ON AGES (N=56)

Variable	Mean±SD	Minimum value	Maximal Value
Age	65.3±3.86	60	73

Table 3 shows muscle strength in the intervention group before intervention (2.71; SD 0.76) and muscle strength after intervention (4.03; SD 0.64). While the muscle strength in the control group before intervention was 3.89 (SD 0.83) and muscle strength after intervention was 3.36 (SD 0.73).

TABLE 3. MUSCLE STRENGTH SCALE BEFORE AND AFTER INTERVENTION (N=56)

Muscle Strength	Intervention			Control		
	Mean	±SD	95% CI	Mean	±SD	95% CI
Before	2.71	0.76	2.41-3.01	3.89	0.83	3.57-4.21
After	4.03	0.64	3.79-4.28	3.36	0.73	3.07-3.64

Based on table 4, there was a significant increase in the mean of muscle strength scale before and after the intervention in the intervention group with a mean difference of 1.32. There was a significant difference in the scale of muscle strength in the intervention group before and after the intervention with p value= 0,000 (p <0.05). The control group showed a decrease in muscle strength scale before and after intervention with a mean difference of -0.53. There were significant differences in the control group before and after the intervention with a value of p = 0.011 (p <0.05).

TABLE 4. DIFFERENCES OF MUSCLE STRENGTH IN THE INTERVENTION AND CONTROL GROUPS (N=56)

Group Difference	Mean	SD	MD	P Value
Intervention				
Before	2.71	0.76	1.32	0.000
After	4.03	0.64		
Control				
Before	3.89	0.83	-0.53	0.011
After	3.36	0.73		

The muscle strength scale in the intervention and control groups before and after the mirror therapy intervention presented in Table 3 shows that the mean of muscle scale after the intervention in the intervention group was 1.32 with a p value <0.001, while the mean value of the muscle scale after intervention in the control group of -0.53 with a p value of 0.011. In conclusion, there are differences in the scale of muscle strength in the intervention group before and after the intervention with the mean difference value of 1.32 and p value 0.000 and

there are differences in the scale of muscle strength in the control group before and after the intervention with the mean difference value of -0.53 and p value 0.011.

Table 5 explains that the mean muscle strength scale in the intervention group after intervention was greater (88.5; SD 0.64) than the mean muscle strength scale in the control group after intervention (3.36; SD 0.73). There is an effect of mirror therapy on the scale of muscle strength in the intervention group with p value = 0.001 (p <0.05).

TABLE 5. EFFECT OF MIRROR THERAPY ON MUSCLE STRENGTH (N=??)

Variable	Mean	±	SD	P value
Intervention	4.03		0.64	0.001
Control	3.36		0.73	

IV. DISCUSSION

There was a balanced number elderly men and women. That is because the researcher did not specify sex type into the inclusion criteria. According to [3] the number of elderly men and women in Central Java Province is balanced at 7.49%. The number of elderly men and women in Boyolali District is equal at 3.43%. The number of elderly men and women in Boyolali District also shows a balanced number [5]. Most of the elderly in Boyolali Regency do not have routine activities outside the home so both elderly men and women participated in the study. Some elderly have completed junior high and high school education. According to [3], the last education level of the elderly is junior high school (35.4%). The elderly who participated in the research are the elderly who considers education is important and needed. In addition, some elderly are migrants from out of town who have at least a secondary education level.

Half of the elderly did not work, including housewives. This is supported by the results of the 2014 National Workforce Survey which stated that 45.41% of the elderly in Indonesia did not work or simply manage their household and 24.24% were unemployed or looking for work. Based on this, the elderly had a lot of free time to participate in activities at the Posyandu Lansia. Elderly who did not have routine activities that require movement are more at risk for muscle weakness. The average age of the elderly is 65.3 years. That is because researchers limit the age range between 60-74 years who are allowed to participate in the study. According to [3], age ratio of the elderly is in the range 55-68 years where life expectancy increases every year. This specific age range is more vulnerable or prone to muscle weakness.

Muscle strength in the intervention and control groups prior to the intervention was in the same range. However, muscle strength in the intervention group after the intervention experienced a significant increase and in the control group it decreased significantly after the intervention. These results are in accordance with the research by [6], [7], [8], [9], [10], [11]. Physiologically elderly will experience muscle weakness so it hinders the fulfillment of daily activities and even prone to injury. There was a significant increase in the intervention group because the mirror therapy was performed as a form of rehabilitative action that relied on motoric visualization.

There were differences in the mean of muscle strength scale before and after the intervention in the intervention and control groups. The results of this study are in line with previous studies conducted by [6], [7], [8], [9], [10], [11]. There are differences in mirror therapy and gymnastic nursing interventions given to the elderly. Mirror therapy can be done independently or assisted by the family at home without limited time and place. This became the great addition value that can solve the problem with the previous routine performed in the Posyandu Lansia. Elderly will find it easier to do mirror therapy because it can be done anywhere and anytime. There is a significant effect of mirror therapy on increasing muscle strength in the elderly. The results of this study are supported by previous studies conducted by [6], [7], [8]; [9] on stroke clients, [10] on adult clients, and [11] in post-stroke clients. The results of the study mentioned that mirror therapy was significantly able to increase the functional abilities of the extremities.

It's important to provide sensory stimulation for motion, vision, and attention to the elderly so they can perform these activities independently. Provision of stimulation in particular feedback is more effective in functional recovery of the upper extremities of clients with stroke [7]. Mirror therapy is a form of nursing intervention that can restore muscle strength in the elderly. This therapy focuses on motor visualization where the mirror as a medium will provide visual stimulation to the body experiencing muscle weakness from healthy body parts [6]. [11] mentions that the elderly will imagine to activate cerebral, ipsilateral, contralateral motor nerves. From the results of this activation leads the movement of limbs that experience muscle weakness through observation of the movement of other healthy limbs. In addition, the full attention of the elderly to the movements carried out is able to influence the increase higher motor skills. That is because the control of motor skills requires the attention and awareness of the elderly to a visual, vestibular, and somatosensory information. This therapy can be carried out in several clinical situations such as phantom limb pain, stroke-induced hemiparesis, and

complex regional pain syndrome [10] however could also be effective in stroke clients in the early stage. This therapy can also be done on clients <60 years [8]. The advantage of this therapy is that it is easy to do, the time is short, the formation of independence, active participation of the elderly, and support from the family.

V. CONCLUSION

There is a significant effect of mirror therapy on increasing muscle strength in the elderly. Mirror therapy is proven to be able to improve muscle strength in the elderly. Mirror therapy is an alternative solution which is one form of complementary nursing interventions that can be integrated with elderly health activities such as Posyandu Lansia or in another health care facilities. The elderly and families can be trained in mirror therapy so they can practice independently at home. Researchers can further develop other forms of nursing intervention that can increase muscle strength and identify the effect of mirror therapy on other variables.

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