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The Effect of a Combination of Hand Therapeutic Exercise and Hand Ball Exercise on Reducing Paresthesia Effects to Improve Functional Activity in the Wrist Area of the Elderly

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ABSTRACT

Elderly individuals (aged >60 years) commonly experience physiological changes that affect various organ functions. In addition to physiological decline, biological factors such as decreased immune function also make them highly susceptible to degenerative diseases. Among these, neuromuscular disorders such as paraesthesia (tingling sensation) are frequently encountered. This study aimed to evaluate the effect of combining hand therapeutic exercise and hand ball exercise in reducing paraesthesia symptoms and improving functional activity in the wrist area of elderly individuals. This research used a quasi-experimental design with a one-group pre-test and post-test approach. The study involved elderly participants from a senior daycare community in Semarang. The Paired Sample Test yielded a significant result with a p-value of <0.001, indicating a statistically significant difference before and after the intervention. The combination of hand therapeutic exercise and hand ball exercise effectively reduces the symptoms of paraesthesia and improves wrist functional activity in elderly individuals.

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INTRODUCTION

Elderly, commonly referred to as older adults, are individuals aged over 60 years. The World Health Organization (WHO) classifies older adults into several age categories: middle age (45–59 years), elderly (60–74 years), old (75–90 years), and very old (above 90 years) (Meliniawati et al., 2024). During the aging phase, several physiological changes occur, including disturbances in the musculoskeletal, cardiovascular, respiratory, nervous, gastrointestinal, urinary, endocrine systems, and changes in the skin (Sugiyo & Caesaria, 2014). Biologically, aging is characterized by continuous deterioration, indicated by a decline in immune function and increased vulnerability to various diseases (Akbar et al., 2021).

Diseases that commonly affect the elderly are known as degenerative diseases, which are conditions characterized by the functional decline of cells in the body, typically occurring with advancing age (Fatihaturahmi et al., 2023). Among the most frequent degenerative

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conditions in the elderly are disorders of the musculoskeletal and neuromuscular systems (Preston & Biddell, 2021). Musculoskeletal problems in older adults are often marked by reduced physical function, muscle strength, and balance, leading to limitations in performing daily activities and increasing the risk of falls. Additionally, hearing and vision impairments may hinder independence in daily tasks (Sholekah et al., 2022). One of the most common neuromuscular disorders found in older adults is paresthesia.

Paresthesia, or tingling sensation, refers to an abnormal sensory experience occurring without specific external stimuli, often described as a prickling or burning feeling. This symptom is usually temporary and may occur in any body part, though it most frequently affects the hands, arms, and legs. Paresthesia is generally caused by abnormalities affecting the somatosensory pathway, most commonly involving peripheral sensory nerves (Mehta et al., 2014). The global prevalence of paresthesia cases is estimated at 13.7%; however, with the increasing elderly population, more than 20% of older adults experience paresthesia accompanied by pain, and approximately 30% of individuals aged 75 years show similar symptoms (Nagai et al., 2023).

In Central Java, 62% of affected individuals are workers in sauce and soy sauce factories (Repilda et al., 2022). A study by Wardana et al. (2018) at Company X in Semarang found that 55% of workers were diagnosed with carpal tunnel syndrome. Furthermore, at the Karangdoro Health Center's elderly daycare program, after distributing the QuickDASH questionnaire and providing explanations about paresthesia, it was found that 53.3% of the elderly experienced moderate-to-severe declines in functional activity due to paresthesia symptoms, 30% reported mild functional decline, and 16.7% experienced no decline in functional activity but reported intermittent tingling sensations. Based on this background, the present study aims to examine the effect of combining Hand Therapeutic Exercise and Hand Ball Exercise on reducing paresthesia symptoms in the wrist area of the elderly to improve their functional activity.

RESEARCH METHOD

This study is a quasi-experimental research employing a one-group pre-test–post-test design approach. The measurement tools used were the QuickDASH questionnaire, which is a shortened version of the Disabilities of the Arm, Shoulder, and Hand (DASH) assessment consisting of only 11 items. This instrument is intended to evaluate an individual's ability to perform daily tasks. Additionally, Manual Muscle Testing (MMT) was utilized as a tool to measure the degree of muscle weakness resulting from disease or injury (Arti & Widanti, 2023).

The study applied a total sampling technique as the sampling method, in which all members of the population were included as research participants, ensuring that no population elements were excluded from the process (Zainuddin et al., 2020). The research population comprised 35 elderly participants drawn from the elderly community of the Daycare Center in Semarang City.

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This study involved two variables: the independent variable was the administration of Hand Therapeutic Exercise and Hand Ball Exercise, while the dependent variable was the improvement of functional activity among the elderly. Both hand therapeutic exercise and hand ball exercise interventions were conducted twice a week, in accordance with previous studies by Rosella Komala Sari et al. (2024) and Unver and Akyolcu (2018).

RESULT AND DISCUSSION

Result

The study was conducted within the Elderly Daycare Community of Semarang City over a period of four weeks, from June 3 to June 25, 2025, with a frequency of two sessions per week. The elderly participants were given a combined intervention consisting of Hand Therapeutic Exercise and Hand Ball Therapy. The primary objective of this study was to determine the effect of the combined exercise therapy in reducing paresthesia symptoms, such as tingling sensations, and improving functional activity in the wrist area of the elderly. Data were subsequently processed and analyzed using the SPSS (Statistical Program for Social Science) software.

Respondent Characteristics Based on Age

Table 1. Frequency Distribution of Respondents by Age

Age (Years)	Elderly Group (Hand Therapeutic & Hand Ball)	
	N	%
45 – 59	3	8,6
60 – 74	29	83,9
75 - 90	3	8,6
Total	35	100

Source: Primary Data, 2025

Referring to Table 1, among the 35 elderly participants, 3 respondents (8.6%) were aged 45–59 years, 29 respondents (83.9%) were aged 60–74 years, and 3 respondents (8.6%) were aged 75–90 years.

Respondent Characteristics Based on Gender

Table 2. Frequency Distribution of Respondents by Gender

Gender	Elderly Group (Hand Therapeutic & Hand Ball)	
	N	%
Male	4	11,4
Female	31	88,6
Total	35	100

Source: Primary Data, 2025

Based on Table 2, the results show that 4 respondents were male (11.4%) and 31 respondents were female (88.6%).

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Respondent Characteristics Based on Occupation

Table 3. Frequency Distribution of Respondents by Occupation

Occupation	Elderly Group (Hand Therapeutic & Hand Ball)	
	N	%
Retired	13	37,1
Housewife	22	62,9
Total	35	100

Source: Primary Data, 2025

Based on Table 3, among the elderly participants who received a combination of hand therapeutic and hand ball exercise, 13 respondents (37.1%) were retirees, while 22 respondents (62.9%) were housewives.

Respondent Characteristics Based on QuickDASH Scores

Table 4. Frequency Distribution of QuickDASH Scores

QuickDASH Score	Elderly Community (Hand Therapeutic & Hand Ball)			
	Pre-Test		*Post-Test*	
	N	%	N	%
10-30 (Miled)	6	17.1	33	94,3
31-50 (Moderate)	25	71.4	2	5.7
51-80 (Fairly Severe)	4	11.4	0	0
Total	35	100	35	100

Source: Primary Data, 2025

Referring to Table .4, the QuickDASH score distribution among the elderly group shows that, before treatment (pre-test), 6 respondents (17.1%) were in the mild impairment category (scores 10–30), 25 respondents (71.4%) were in the moderate impairment category (scores 31–50), and 4 respondents (11.4%) were in the fairly severe category (scores 51–80). After the intervention (post-test), 33 respondents (94.3%) scored in the mild impairment range (10–30), while only 2 respondents (5.7%) remained in the moderate category (31–50).

Respondent Characteristics Based on MMT Scores

Table 5. Frequency Distribution of MMT Scores

MMT Score	Elderly Community (Hand Therapeutic & Hand Ball)			
	Pre-test		*Post-test*	
	N	%	N	%
1-2	0	0	0	0
3-4	28	80	10	28,6
5	7	20	25	71,4
Total	35	100	35	100

Source: Primary Data, 2025

As shown in Table 5, before the intervention (pre-test), 28 elderly participants (80%) had MMT scores of 3–4, indicating full range of motion (ROM) capable of resisting gravity and

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minimal resistance, while 7 participants (20%) had MMT scores of 5, indicating full ROM with the ability to resist gravity and maximal resistance. After the intervention (post-test), 10 participants (28.6%) had MMT scores of 3–4, and 25 participants (71.4%) achieved MMT scores of 5, indicating full ROM with maximal resistance capacity.

Normality Test

Table 6. Normality Test Results

QuickDASH Score	Shapiro Wilk Normality Test	
	Elderly Group (Hand Therapeutic & Hand Ball)	
	P	Description
Pre-Test	0,274	Normal
Post-Test	0,827	Normal

Source: Primary Data, 2025

Based on Table 6, the normality test was analyzed using the Shapiro–Wilk method. Before treatment (pre-test), the obtained p-value was 0.274, and after treatment (post-test), the obtained p-value was 0.827. Based on these results, since the p-value > 0.05, the data can be considered normally distributed.

Influence Test

Table 7. Influence Test Results

Group	Paired Sample Test			
	Mean		P	Description
	Pre test	Post test		
Combination of Hand Therapeutic & Hand Ball Exercise	39,05	22,60	0,001	Significant Effect

Source: Primary Data, 2025

Based on Table 7, the results of the paired sample test showed a p-value of <0.001. According to the statistical test results, since the p-value < 0.05, it can be concluded that there is a significant effect of the treatment applied.

Discussion

Respondent Characteristics Based on Age

According to Table 1, the majority of the samples were aged between 60–74 years, with the smallest group being in the 45–59 age range. As stated by Ramadhani et al. (2023), as individuals age, they tend to experience more than two types of health problems, such as musculoskeletal, neuromuscular, cardiovascular, and integumentary disorders. These conditions are commonly found among older adults and are often caused by factors such as loss of muscle mass, changes in lifestyle, decreased muscle strength, reduced nerve sensitivity, and deterioration of neural components. Pain complaints are also frequent, particularly when accompanied by damage to tendons, ligaments, joints, nerves, and muscles (Setyawan & Aktifah, 2024).

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Respondent Characteristics Based on Gender

As shown in Table 2, there were 4 male and 31 female elderly participants. According to Selviyati et al. (2016), in women, menopause and, in men, hormonal changes both contribute to an increased risk of developing paresthesia. This is due to structural enlargement in the wrist area, which may compress the nerves in the hand region.

Respondent Characteristics Based on Occupation

Table 3 shows that housewives represented the largest group, totaling 22 elderly participants, followed by 13 retirees. As stated by Savitri (2024), women are among the individuals most frequently engaged in repetitive domestic tasks, such as sweeping, mopping, washing clothes, and cooking. Prolonged engagement in such repetitive activities is one of the contributing factors to the occurrence of paresthesia symptoms, which may interfere with their functional activities in performing daily chores.

Respondent Characteristics Based on QuickDASH Scores

According to Arti and Widanti (2023), the QuickDASH is a shortened version of the DASH instrument consisting of 11 items, with score ranges classified into six categories: 0–9 (mild impairment), 10–30 (moderate impairment), 31–50 (fairly severe impairment), 51–80 (severe impairment), and >100 (total impairment). Based on Table 4, there were approximately 3 elderly participants with mild impairment, 29 with moderate impairment, and 3 with fairly severe impairment. From these data, it can be concluded that the majority of elderly respondents experienced moderate functional impairments. The QuickDASH assessment focuses on evaluating an individual's functional ability to perform daily activities, serving as an important benchmark since elderly individuals with paresthesia symptoms typically experience functional limitations, particularly in the wrist area.

Respondent Characteristics Based on MMT Scores

According to Table 5, prior to the intervention (pre-test), most respondents had MMT scores of 3–4, categorized as full range of motion (ROM) capable of resisting gravity and minimal resistance, totaling 28 elderly participants. Meanwhile, 7 elderly participants scored 5, categorized as full ROM capable of resisting gravity and maximal resistance. After the intervention (post-test), 25 elderly participants achieved MMT scores of 5 (full ROM with maximal resistance), while 10 elderly participants remained at MMT scores of 3–4. The relationship between elderly individuals and their MMT scores indicates that aging increases susceptibility to degenerative diseases, such as musculoskeletal disorders, which are typically marked by reduced physical function, muscle strength, and endurance. In chronic conditions, these issues may lead to neuropathic complications that impair motor function, resulting in decreased mobility, muscle weakness, and atrophy, ultimately reducing the elderly's overall functional capacity (Nurjannah et al., 2023).

CONCLUSION

Based on the results of the analysis and statistical tests on "The Effect of a Combination of Hand Therapeutic Exercise and Hand Ball Exercise on Reducing Paresthesia Effects to Improve Functional Activity in the Wrist Area of the Elderly" conducted at the Elderly Daycare

Center in Semarang City, using the QuickDASH as an instrument for evaluating functional ability, it can be concluded that there is a significant effect of the combined implementation of Hand Therapeutic Exercise and Hand Ball Exercise. This combination effectively reduces the effects of paresthesia and enhances the functional activity of the elderly. The statistical test results showed a p-value of <0.001 (p<0.05). Based on this finding, the alternative hypothesis (H1) stating that the combination of Hand Therapeutic Exercise and Hand Ball Exercise has a significant effect on reducing paresthesia and improving wrist functional activity in the elderly is accepted.

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