# Effect of Hand Exercise and Mindfulness Stress Reduction Intervention on the Symptoms' Severity of Carpal Tunnel Syndrome among Elderly Patients

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#### Abstract

Background: The everyday lives of the elderly are significantly impacted by carpal tunnel syndrome. Exercise and mindfulness techniques are two non-pharmacological methods used to reduce symptoms of carpal tunnel syndrome. Aim: The present study aimed to evaluate the effect of hand exercise and mindfulness stress reduction intervention on the symptoms' severity of carpal tunnel syndrome among elderly patients. Design: A quasi-experimental research design. Sample: purposive sample of 90 elderly patients. Setting: This study was carried out at the physiotherapy and rehabilitation unit in Minia University Hospital, Egypt. Methods: Three tools were used for collecting data namely, a structured interviewing Questionnaire, Boston carpal tunnel syndrome Questionnaire, and Five facet mindfulness questionnaires Result: There was a high statistical improvement in symptoms severity, function status, and mindfulness condition on combined hand exercise and mindfulness stress reduction intervention group more than other groups. Conclusion: the combined hand exercise and mindfulness stress reduction intervention had more effect on reducing the symptoms severity among elderly people with carpal tunnel syndrome. Recommendation: Increase patient's awareness regarding the effectiveness of hand exercises and mindfulness techniques through effective teaching media such as videos, role play, and demonstration.

Keywords: carpal tunnel syndrome, elderly, hand exercise & mindfulness stress reduction intervention.

#### Introduction:

Carpal tunnel syndrome (CTS) is one of the most common peripheral neuropathies of the upper extremities, which is a condition involving entrapment of the median nerve in the carpal tunnel area of the wrist. Its prevalence ranges from 1-5% of the general population and rises to 11.7% in working-class populations. Women are more likely than men to be affected by CTS, with a 3 to 10 times higher prevalence than men. Conditions like rheumatoid arthritis, diabetes, obesity, and osteoarthritis may have a role in the development of this disorder (**Cereceda-Muriel, et al., 2024**).

The hand region innervated by the median nerve experiences parenthesis, numbness, pain, tenor atrophy, and loss of muscle strength as symptoms of CTS. These symptoms can cause insomnia and cause vasomotor issues like perspiration and loss of reflexes. The radial side of the thumb, index finger, middle finger, and ring finger that is, the median nerve distribution-is where these CTS symptoms primarily appear. Risk factors encompass diabetes. obesity, rheumatoid disorders (osteoarthritis or rheumatoid arthritis), female gender, repeated wrist movements, and more. Strains in wrist flexion or extension and repetitive usage of the flexor muscles are ecological risk factors. Wrist repetition has made carpal tunnel syndrome more common. (Bicki, et al., 2024).

Clinical symptoms, including pain, paraesthesia, and numbness, along with electrophysiological diagnostic tests, are used to diagnose CTS. It has long been known that certain workplace hazards exist, such as vigorous, repetitive hand labor, wrist extension and vibration, and chilly environments (Li, et al., 2022). Early intervention for CTS may prevent median nerve degeneration, enhancing patients' quality of life and lowering neuropathy treatment expenses (**Beddaa et al.**, **2022**).

One option of treatment suggested by the American Academy of Orthopedic Surgeons is a therapeutic exercise regimen. The pressure on the median nerve at the wrist may be lessened by exercise. To ease symptoms, they can be used in conjunction with medication, activity modifications, bracing, and/or splinting. Certain activities that facilitate the median nerve's easier movement within the carpal tunnel may be beneficial for certain people. Additionally, joint range of motion and hand function can be improved by workouts intended to facilitate tendons' passage through the carpal tunnel. In addition, friction and carpal tunnel symptoms are eliminated by decreasing the impingement of the tendons and median nerve (American Academy of Orthopaedic Surgeons, 2024& Ünver, & Akyolcu, 2018).

A level of awareness, focus, and openness known as mindfulness enables people to completely participate in the here and now. Difficult thoughts, feelings, and sensations are observed without passing judgment and are not let to influence behavior when one is in a state of mindfulness (**Bekes et al., 2018**). There is a connection between CTS and perceived stress. The explanation is that stress, worry, and emotional suffering alter how the body works. Stress triggers the body to release hormones that can lead to edema and inflammation. CTS may occur as a result of the pressure this inflammation places on the median nerve (**Jokar et al., 2022**).

Moreover, social isolation and personal losses are two more stressors that can be brought on by CTS and the functional deficits that are linked to it. Higher psychological discomfort brought on by these stressors may worsen stress reactions and pain perception, as well as hinder functional recovery. Numerous studies have demonstrated the effectiveness of mindfulness skills training therapies in improving physical function and reducing pain intensity in chronic pain patients. Patients who practice mindfulness become more conscious of their thoughts, feelings, and pain sensations without passing judgment on them or making an effort to ignore or avoid them; by avoiding thoughts about pain, the threat associated with pain is reduced, and patients can carry out activities despite their discomfort (**Kurtul & Mazican, 2023**).

In order to help elderly patients with CTS reduce CTS symptoms and improve functional status, the nurse should teach the patient how to perform hand exercises and mindfulness stress reduction techniques. Before beginning the exercises, the patient's hands should be gently heated. Additionally, the nurse ought to counsel patients on using a wrist splint to provision and restrain the wrist (Abdel Maksoud & Ramadan, 2021).

# Significant of the study:

CTS occurrence varies widely; it ranges from 8.0% among the general population particularly adults between the ages of 40-60 years. Moreover, the elderly have a two- to three-fold increased risk compared to young ones. In Egypt, it was 1.7% and 3.1 % in two population-based surveys conducted in Assiut and Qena Governorate, respectively (Al Shahrani et al., 2021&Elsharkawy et al., 2023).

The significant impact carpal tunnel syndrome has on a person's quality of life, how common it is, and how much it costs health systems. In order to cure and avoid the recurrence of symptoms, the nurse is essential in providing accurate knowledge about how to use body mechanics correctly, how to keep good posture while working and during daily activities, and how to undertake certain exercises (**Shaheen, & Mohamed, 2021**).

Combining HE and MBIs in interventions may yield augmented effects relative to either component alone. The two approaches likely operate through complementary mechanisms: mindfulness training might facilitate initial engagement in HE by encouraging an accepting, non-judgmental attitude to one's potentially uncomfortable experience, and in turn, engagement in PA can boost an individual's sense of achievement and motivation to continue engaging. These effects can create a beneficial cycle of behavior. There are also shared neuropsychological mechanisms between the two techniques, whereby engaging in both practices is likely to reinforce the 'lessons' learned and experienced benefits.

Because studies about hand exercise and mindfulness among elderly patients with carpal tunnel syndrome in Minia are scarce, this study aimed to evaluate the effect of hand exercise and mindfulness stress reduction intervention on the symptom's severity of carpal tunnel syndrome among elderly patients.

## Aim of the study:

The present study aimed to evaluate effect of hand exercise and mindfulness stress reduction intervention on the symptoms' severity of carpal tunnel syndrome among elderly patients.

## Research hypothesis:

H1: Elderly Patients with carpal tunnel syndrome who receive a combined hand exercise and mindfulness stress reduction intervention is expected to be better than hand exercise only group and mindfulness stress reduction intervention-only group.

## Subjects and methods

## **Research design:**

A quasi-experimental research design was utilized in the current study

## Settings:

The current study was conducted at the physiotherapy and rehabilitation unit (located on the ground floor of Minia University Hospital which is affiliated with Minia City, Egypt.

# Subjects:

A purposive sample of 90 patients was utilized in the current study. The sample size was estimated centered on (Isaac and Michael, 1995) formulation which is calculated as (N=nx30/100) in which:

## N= Sample size

An overall number of 300 patients underwent the physiotherapy and rehabilitation unit in Minia University Hospital during the last year.

N=300 x 30/100 = 90 patients that were distributed for 3 groups as follows:

30 patients for the hand exercise group (group 1), another 30 patients for mindfulness stress reduction interventions group (group 2), and the last 30 patients for combined hand exercise and mindfulness training group (group 3).

## Patients' inclusion criteria:

- An elderly patient with confirmed carpal tunnel syndrome diagnosis in the mild stage
- Capable of verbal communication and following directions.
- Didn't spend the previous two months period engaging in regular hand exercises and mindfulness exercises.
- Agree to participate in the study

## Exclusion criteria: -

- Patients with apparent cognitive impairment or bad general health that interfere with patient's cooperation.
- physical disability
- Hand or wrist deformity
- Previous history of CTS surgery

# **Study Tools:**

Three tools were used by the researchers to gather the needed data based on the review of relevant literature.

- Tool (I): Demographic and Clinical Data Interview questionnaire: The researchers developed this tool after reviewing related literature (Gado et al., 2016 & Gomaa et al., 2022 and Fateh et al., 2022) to gather the demographic and medical parameters. It was obtained for fifteen min. Just once at a first interview. It split into two primary parts:
- **Part 1: Demographic data:** It was used to collect demographic characteristics of elderly patients with carpal tunnel syndrome such as age, level of education, gender, occupation, marital status, and residence.
- Part 2: Patient's Clinical Data: Clinical data include: the presence of chronic disease, nerve compression, hand pain, history of physiotherapy, previous hospitalization,

and prescribed medications and over-of-the-counter medication used.

Tool (II): Functional Status and Symptoms Severity questionnaire for patients with carpal tunnel syndrome. It is a selfadministered questionnaire which adapted from Beaton et al., (2000). It was composed of two scales: the symptom severity scale (SSS) and the functional status scale (FSS). The (SSS) entails 11 items, integrating 6 domains (pain, numbness, paresthesia. nocturnal weakness. overall symptoms, and functional status) and the FSS consists of 8 functional activities commonly affected by CTS (writing, buttoning clothes, holding books while reading, gripping of a telephone handle, carrying grocery basket, household chores opening jars, bathing and dressing). The questionnaire was conducted twice: first right after the provision of informed permission, and then just after finalizing the training program for all participating groups. It took about thirty minutes to finish the questionnaire.

## Scoring system

An algorithm for scoring: Every item on the symptom severity scale (SSS) has five possible points on a Likert scale, with 1 denoting no symptoms and 5 denoting the worst symptoms.

Every response on the functional status scale is rated from 1 (the easiest) to 5 (the most difficult) using a 5-point Likert scale. The mean of the eight functional status scores was used to get the final score. Therefore, worse

#### Scoring system:

symptoms or dysfunction are indicated by higher symptom severity or functional status score.

Severity Level	Score
Asymptomatic	11
Mild	12-22
Moderate	23-33
Sever	34-44
Very severe	>45

<b>Functional status</b>	Score
No difficulty	1-8
Little	9-16
Moderate	17-24
Intense	25-32
Cannot perform the	> 32
activity at all	

#### Tool III: Five facet mindfulness questionnaires.

It adopted from Elbahiry et al. (2014) translated the Five Facet Mindfulness Questionnaire (FFMQ), which was taken from Baer et al. (2006). The 39-item FFMQ is scored using a 5-point Likert scale, with 1 denoting never or extremely rarely true and 4 denoting very often or usually true. The following five subscales of the FFMO were created by the questionnaire's developers using exploratory factor and confirmatory factor analyses on all items using multiple mindfulness measures: observing, describing, acting with awareness, no judging of inner experience, and non-reactivity. The survey was conducted twice: first right after the provision of informed permission, and then just after finalizing the training program for groups 2 & 3. Approximately 15 min was required to complete the questionnaire.

Facet	Statements that measure it	Scoring Pattern
1. Observation	1, 6, 11, 15, 20, 26, 31, 36	All directly scored
2. Description	2, 7, 12, 16, 22, 27, 32, 37	12, 16, and 22 – Reverse Items
3. Aware actions	5, 8, 13, 18, 23, 28, 34, 38	All reverse-scored items
4. Non-judgmental inner critic	3, 10, 14, 17, 25, 30, 35, 39	All reverse-scored items
5. Non-reactivity	4, 9, 19, 21, 24, 29, 33	All directly scored items

FFMQ	%
Low	<50 %
Moderate	50-75 %
High	>75 %

The subsequent categories were assigned to FFMQ scores:

## Validity of the tools:

A group of five professionals in the fields of psychiatry, community health, and geriatric nursing reviewed and reevaluated the tools. The panel examined the tools to ensure that they were understandable, applicable, comprehensive, and clear. On the advice and opinions of specialists, small adjustments have been made, like rewording and rearranging a few sentences.

## **Reliability:**

The reliability of the recommended instruments was evaluated by Cronbach's alpha coefficient test. The structured interview questionnaire's Cronbach's alpha of 0.89 suggested a strong positive correlation between its components, while the BCTQ's test-retest reliability was 0.95 and the Five Facet Mindfulness Questionnaire's reliability was 0.96.

# 1. Administrative phase:

Official letter permission was obtained from the Faculty of Nursing at Minia University and directed to the hospital director, the head of the physiotherapy and rehabilitation unit, and the head nurses of the setting after an explanation of the aim of the study.

# Pilot study:

Nine elderly patients (10%) who met the eligibility requirements participated in a pilot study to assess the study tools' applicability, relevance, and intelligibility changes were made to the instruments to incorporate them into the study in light of the findings.

# 2. Data collection phase:

Ethical Consideration: The ethics committee of the nursing faculty at Minia University approved the study after reviewing the protocol. During the face-to-face recruitment phase, each elderly patient verbally consented after being told of the research study's objectives. Elderly patients were completely free to decline or withdraw at any time. The questionnaire did not contain any questions that could expose the identities of the participants to preserve their secrecy and anonymity.

## 3. Phases of the intervention program:

## Assessment phase:

Once official permission was granted. A thorough analysis of relevant past and recent books and papers related to the topic of the study to obtain a comprehensive overview regarding all variables related to the research problem. The researchers visited the selected location to organize and set up the procedures for recruiting, gathering data, and intervening before beginning data collection. This phase aided in the conception, development, and direction of the nursing protocol for the study.

## Implementation phase:

Following baseline evaluation, three groups were randomly assigned to the eligible individuals based on the inclusion criteria. The first group assigned for hand exercise only; receives exercise training for hands. The second group is the mindfulness group who received mindfulness stress reduction-based interventions and the third group which received combined hand exercise and mindfulness interventions. The data collection for the current study took place over a period of 6 months, from the first of April 2024 to the end of September 2024.

All the participants patients in all groups were interviewed by the researchers who explained the aim of the study, expected implications and gained their acceptance to participate in the study. After that the researchers started to collect data by using tool I within approximately 15 minutes and tool II (pre-test) within approximately 30 minutes to collect the necessary data, according to patients' responses, after explaining the purpose of the study. While tool III was applied for groups 2 & 3 only it was required around 15 minutes.

Patients in group one were given an instructional booklet regarding exercise which included a definition of metacarpal tunnel syndrome, warm-up exercises, and multicomponent exercise programs such as stretches for the wrist flexors and extensors, and Medial Nerve Glides. Patients were instructed to cease exercising if they experienced pain or weariness. The patients in group 2 received a brochure regarding the different mindfulness techniques and instructed them to follow it

The third group received both a hand exercise booklet and a mindfulness techniques brochure and photos and illustrations to help the patient's understanding of the contents and to help them remember the exercise routines and encourage them to perform the exercises at home, as well as for additional information and reference. On the monthly follow-up plan, patients noted the amount of time they spent performing the hand exercises and mindfulness techniques each day.

The program was divided into two parts. **Part one (theoretical session)** in which researchers started with providing information using media, posters, and videos over two sessions (each lasting 30 min) covering the following items: greetings, aim, the purpose of the study, the time needed for each session, physiological and psychological associated with carpal tunnel syndrome, mindfulness and its mechanism, the importance of hand exercise and mindfulness stress reduction exercises for the elderly and their caregivers. Patients performed the intervention with guidance and close monitoring by the researcher for a period of 20 to 30 minutes.

Throughout the six months' study, hand exercises as well as mindfulness training were performed once a day for each participant. **Part Two: (Demonstration and re-demonstration about exercise)** over six sessions which included hand exercises for groups 1 & 3 as well as, the mindfulness stress reduction intervention for groups 2 & 3.

1. Group of hand exercise: Each elderly person in the hand exercise group performed a series of motor exercises started with 5 minutes of warm-up exercises for wrist, followed by 30-40 minutes of multicomponent exercise program as stretches for the wrist flexors & extensors and medial nerve glides exercise. Stretching the wrist flexors includes straightening the arm, palm down, and bending the wrist so that the fingers point downward. Gently move the hand towards the body with the other hand until the outside of the forearm stretches. Wrist extensor stretches are performed by straightening the arm and bending the wrist back. Next, lightly press across the palm with the other hand and pull it back till the inside of the forearm feels stretched.

For the two exercises, the older patients were instructed to hold each stretch for 15 seconds, and finally medial nerve glides exercise includes 1) Begin with your wrist in a neutral position, fingers and thumb bent into a fist, with your thumb facing you. 2) Extend your fingers and thumb into a straight, neutral position. 3) Keeping your fingers and thumb straight, bend your wrist so that your palm faces up. 4) Keeping your hand in the same position, extend your thumb away from your hand. 5) Keeping your hand and fingers in the same position, rotate your wrist so that your palm faces away from you. 6) While in position 5, gently pull down on your thumb with your free hand. Hold each position for 5 seconds and repeat series 3 to 5 times.

2. Group of mindfulness: Each elderly person in the mindfulness stress reduction exercise group performed a series of mindfulness exercise (one exercise per session) guided by the researchers as breathing technique, body scanning exercise, leaves on stream technique, practicing loving, kindness and compassion, sitting with difficult emotions, and grounding exercise with sensory awareness 10 to 15 min in session. Each session was performed once a week by the researchers. In each session the researcher introduced the exercise concerning content of the session, discussing each session with participants at each point until patients be able to practice well. After that the participants offered with videos and brochure to guide them during practice the techniques at home.

3. Combined hand and mindfulness training group: Each elderly person in this group perform the same hand exercises mentioned before, in addition to mindfulness training which involves guided practice on a set of specific tasks designed to solicit targeted cognitive functions for 40-50 minutes.

**Evaluation phase:** Each patient evaluated:

- **1- First Time Evaluation:** pre intervention (baseline).
- **2- Second Time Evaluation:** post intervention after two months.

Following the recommended intervention's implementation, the BCTQ and FMM were used

to compare the degree of and functional status between pre-test and posttest. All groups underwent this evaluation, which was conducted through an interview during the follow-up visit.

#### **Data Analysis**

(SPSS) version 22 was utilized to arrange, classify, also analyze the collected data. For qualitative and quantitative variables, respectively, the mean as well as standard deviations of the data were reported utilizing descriptive statistics, correlation r-test were the statistical tests that were applied. When the p-value was below 0.05, strong significance was assumed, and no statistical significance difference was taken into account when the p-value was higher 0.05.

#### **Result:**

**Table (1)**: presents that the mean ages of the three groups were  $(66.2\pm2.4)$ ,  $(68.8\pm4.4)$ , and  $(71.3\pm3.9)$  years old in hand exercise, mindfulness, and hand exercise mindfulness respectively. Concerning gender, it was observed that, 60.0%, 56.7 % & 70.0% respectively of these groups were female, 73.3%, 66.7% & 70.0% of these groups living in rural areas, and 43.4% & 53.3%, respectively of them married. Moreover, no statistically significant differences were found for these characteristics among the groups.

**Table (2):** display the most frequency diseases among studied elderly patients is osteoarthritis, follow by diabetes then hypertension. 41.1 % of them had pain in right hand, also, 71.1 % of them did not receive physiotherapy, 58.9 % of them had history of hospitalization and 48.9% of them had overweight.

**Table (3)**: shows that there was a significant difference among the studied groups on functional status and Mindful Attention Awareness, while there is no significant difference in symptom severity in the mindfulness group only.

**Table (4):** The table reveals that mean scores of Symptoms severity and Functional status of the hand exercise and mindfulness program group are significantly lower than the hand exercise and mindful groups only. While mean scores of the subscales of the five facets of mindfulness of hand exercise and mindfulness program group are significantly higher than the hand exercise and mindful groups only.

**Table (5)**: shows that there is a high significant correlation between Symptom severity and Functional status (r = 0.572,  $p = 0.001^{**}$ ). There is also a significant correlation between the Five facets of mindfulness and Symptom severity (r = 0.358,  $p = 0.003^{**}$ ), as well as between the Five facets of mindfulness and Functional status (r = 0.421,  $p = 0.002^{**}$ ).

<b>.</b>	Hand exercise		Mind	fulness	Hand and 1	Р.	
Personal data	group		gro	oup	gro	ups	value
	Ν	%	Ν	%	Ν	%	varue
Age (years)							
60-	14	46.7	17	56.7	12	40.0	
70-	12	40.0	7	23.3	15	50.0	0.231
<u>&gt;</u> 80	4	13.3	6	20.0	3	10.0	
Mean +SD	66.2	±2.4	68.8	±4.4	71.3	±3.9	
Gender							
Male	12	40.0	13	43.3	9	30.0	0.476
Female	18	60.0	17	56.7	21	70.0	0.470
Residence							
Rural	22	73.3	20	66.7	21	70.0	0.726
Urban	8	26.7	10	33.3	9	30.0	
Education level							
Elementary	10	33.3	14	46.7	20	66.7	
Secondary	13	43.4	16	53.3	7	23.3	0.060
High education	7	23.3	0	0.0	3	10	0.009
Occupation							
Worked	14	46.7	5	16.7	9	30.0	0.210
Not worked	16	53.3	25	83.3	21	70.0	
Marital status							0.807
Married	23	76.7	20	66.7	22	73.3	0.097
Unmarried	7	23.3	10	33.3	8	26.7	

 Table (1): Distribution of the different studied groups according to personal data

\* Statistical significant difference (P ≤ 0.05)

\*\* highly Statistical significant difference (P ≤ 0.01)

clinical data	Hand exercise group		Mindfulness Group		Hand and mindfulness groups		Total	
	N	%	Ν	%	Ν	%	Ν	%
Presence of chronic disease*								
No	3	10.0	0	0.0	1	3.3	4	4.4
Diabetes	12	40.0	20	66.7	16	53.3	48	53.3
Hypertension	16	53.3	8	26.7	17	56.7	41	45.6
Endocrine diseases	5	16.7	1	3.3	8	26.7	14	15.6
Gastric	6	20.0	12	40.0	13	43.3	31	34.4
Kidney problems	9	30.0	2	6.7	12	40.0	23	25.6
Osteoarthritis	17	56.7	12	40.0	20	66.7	49	54.4
Cancer	0	0.0	2	6.7	1	3.3	3	3.3
Other	1	3.3	3	10.0	2	6.7	6	6.7
Nerve compression								
Yes	12	40.0	4	13.3	17	56.7	33	36.7
No	7	23.3	12	40.0	5	16.7	24	26.6
Don't know	11	36.7	14	46.7	8	26.7	33	36.7
Hand pain								
Left	10	33.3	8	26.7	13	43.4	31	34.4
Right	12	40.0	15	50.0	10	33.3	37	41.1
Both	8	26.7	7	23.3	7	23.3	22	24.5
History of Physiotherapy								
Yes	9	30.0	11	36.7	6	20.0	26	28.9
No	21	70.0	19	63.7	24	80.0	64	71.1
Previous hospitalization								
Yes	18	60.0	20	66.7	15	50.0	53	58.9
No	12	40.0	10	33.3	15	50.0	37	41.1
Body Mass Index								
Under weight	2	6.7	5	16.7	2	6.7	9	10.0
Normal weight	7	23.3	8	26.7	5	16.7	20	22.2
Overweight	15	50.0	10	33.3	19	63.3	44	48.9
Obese	6	20.0	7	23.3	4	13.3	17	18.9

Table (2): Distribution of the di	ifferent studied groups	according to clinical data
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**Table (3):** Comparison between the Study Groups Regarding their Symptoms severity, Functional<br/>status, and FMMQ at pre- and post-program (n = 90)

	Hand exerc	cise group	P	Mindfu Gro	ılness up	D	Hand and m grou	indfulness 1ps	D
Items	Pre (baseline)	Post (2 months)	r. Value	Pre (baseline)	Post (2 months)	r. value	Pre (baseline)	Post (2 months)	r. value
Symptoms severity									
Asymptomatic	1 (3.3)	3 10.0)		0(0.0)	0(0.0)		2 (6.7)	5 (16.7)	
Mild	3 (10.0)	6 (20.0)		4(13.3)	5 (16.7)		0 (0.0)	8 (26.7)	
Moderate	6 (20.0)	6 (20.0)	0.05	5 (16.7)	8 (26.7)	0.520	10 (33.3)	13(43.3)	0.001**
Severe	8 (26.7)	8 (26.7)		8 (26.7)	10 (33.3)		8 (26.7)	3 (10.0)	0.001
Very severe	12 (40.0)	7(23.3)		13(43.3)	7(23.3)		12 (40.0)	1 (3.3)	
Functional status									
No difficulty	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)		0 (0.0)	3 (10.0)	
Little difficulty	3 (10.0)	5 (16.7)		4(13.3)	7(23.3)		3 (10.0)	11 (36.7)	
Moderate difficulty	10 (33.3)	20 (66.7)	0.0)35*	8 (26.7)	12 (40.0)	0.02*	7(23.3)	12 (40.0)	0.001**
Intense difficulty	15 (50.0)	4(13.3)		17 (56.7)	11 (36.7)	0.02*	16 (53.3)	3 (10.0)	0.001**
Cannot perform the activity at al	2 (6.7)	1(3.3)		1 (3.3)	0 (0.0)		4(13.3)	1(3.3)	
FMM									
Low	10 (33.3)	8 (26.7)		15 (50.0)	3 (10.0)		11 (36.7)	1 (3.3)	0.001**
Moderate	16 (53.4	12 (40.0)	0.0)4*	13(43.3)	11 (36.7)	0.00**	15 (50.0)	7(23.3)	0.001
High	4(13.3)	10 (33.3)		2 (6.7)	16 (53.3)		5 (16.7)	22(73.4)	

\* Statistical significant difference ( $P \le 0.05$ )

\*\* highly Statistical significant difference (P ≤ 0.01)

Iterre	Hand exercise group		Mindi Gr	fulness oup	Hand exe mindfulne	P.	
Items	Pre (baseline)	Post (2 months)	Pre (baseline)	Post (2 months)	Pre (baseline)	Post (2 months)	Value
Symptoms severity	43.77 <u>+</u> 4.30	23.77 <u>+</u> 2.55	43.44 <u>+</u> 3.66	39.12 <u>+</u> 2.80	34.53 <u>+</u> 2.78	20.40 <u>+</u> 4.3	0.002**
Functional status	27.72 <u>+</u> 3.5	19.77 <u>+</u> 1.88	28.09 <u>+</u> 2.1	20.84 <u>+</u> 4.8	26.88 <u>+</u> 4.99	17.33 <u>+</u> 6.33	0.001**
Five facets of mindfulness							
Observing	12.5 <u>+</u> 1.4	13.9+2.1	12.2+3.1	16.0 +1.7	11.6 +2.4	18.9 +1.8	0.035
Describing	12.6 <u>+</u> 1.4	13.0+1.8	12.7+2.2	16.1 +1.9	12.5 +1.8	19.3 +1.8	0.05
Acting with awareness	11.9 <u>+</u> 1.6	12.8+2.9	11.3+1.9	15.3 +1.6	12.0 +1.6	18.6+1.9	0.000*
Non-judging of inner experience	11.6 <u>+</u> 1.6	13.3+1.6	12.0+1.4	14.7 +1.8	11.6 +1.7	17.5 +1.6	0.001**
Non-reactivity to inner experience	12.1 <u>+</u> 1.9	13.6+1.9	11.9+3.1	15.8 +2.1	12.9 +2.7	17.5 +2.0	0.05*

Table (4): Comparison of the mean scores between pre and post-period according to Boston carpal tunnel syndrome functional status and Mindful Attention Awareness (n = 90)

\* Statistical significant difference ( $P \le 0.05$ ) \*\* highly Statistical significant difference ( $P \le 0.01$ )

Table (5): Correlation between elderly patients' Symptoms severity, their Functional status, and their Five facets of mindfulness

Parameter		Symptoms severity	Functional status	Five facets of mindfulness
Symptoms severity	r.			
	р.			
Functional status	r.	0.572		
	р.	0.001**		
Five facets of mindfulness	r.	0.358	0.401	
	р.	0.003**	0.002**	

\* Statistical significant difference ( $P \le 0.05$ ) \*\* highly Statistical significant difference ( $P \le 0.01$ )

## **Discussion:**

In order to effectively treat CTS, a comprehensive strategy focused on symptom reduction and improved wrist function is required. Physical therapists play a critical part in this process by personalizing treatment programs based on the severity of the ailment, patient preferences, and any contraindications. It is essential to receive early diagnosis and treatment to stop permanent damage to the nerves and muscles. Targeted exercises, manual treatment, and maybe electrotherapy are some of the physical therapy procedures used to improve muscular strength and coordination and relieve pain and sensory problems.

Patient education regarding lifestyle changes lowers the chance of recurrence and supports symptom management even more. It is advised that patients receive individualized rehabilitation programs to meet their unique needs and support long-term functional recovery and general well-being (Bicki, et al.,

**2024**). The present study pointed to evaluating the effect of hand exercise and mindfulness stress reduction intervention on the symptom severity of carpal tunnel syndrome among elderly patients.

Regarding age, the current study showed that the mean ages of the three groups were  $(66.2\pm2.4)$ ,  $(68.8\pm4.4)$ , and  $(71.3\pm3.9)$  years old in-hand exercise, mindfulness, and hand exercise& mindfulness respectively. This result may be due to increased age increases health problems which increases the risk of carpal tunnel syndrome. This finding is in the same line with a study by San Ko, et al., (2018) who conducted a study about "Carpal Tunnel Syndrome in Elderly Patients" and illustrated that the incidence of carpal tunnel syndrome increases with age with the mean age of the studied patients was 69.2+5.6 years old.

The current study displayed that carpal tunnel syndrome in females more than in males. This finding may be due to hormonal changes that could affect fluid retention, especially during post-menopause. Swelling can reduce available space in the carpal tunnel and compress the median nerve. This result is in the same line with a study by **Torun, & Tuncer, (2023)** who carried out "A comparison of manual therapy and extracorporeal shockwave therapy in patients with carpal tunnel syndrome" and found that most of the patients with carpal tunnel syndrome were females.

Conversely, this finding was in disagreement with Unver, & Akyolcu, (2018) entitled "The effect of hand exercise on reducing the symptoms in hemodialysis patients with carpal tunnel syndrome" and found that most of the studied patients were male patients with carpal tunnel syndrome. Also, Minhas, et al., (2023) entitled "Comparing the effects of carpal bone mobilization and tendon gliding in patients with carpal tunnel syndrome" showed that less than two-thirds of the studied patients were males had carpal tunnel syndrome.

The current study illustrated that the most frequent disease among studied elderly patients with carpal tunnel syndrome was osteoarthritis, followed by diabetes then hypertension. This may be due to osteoarthritis or diabetes can develop CTS from repetitive strain, and injury, which increases susceptibility to median nerve compression. This result was in agreement with a study by Genova, et al., (2020) who conducted a study about "Carpal tunnel syndrome" and displayed that osteoarthritis and diabetes are risk factors for Carpal tunnel syndrome in older adults.

Concerning body mass index among the studied elderly women, the result of the current study displayed that about half of them were overweight. This finding may be due to the overweight increased risk of diabetes, high blood pressure, and inflammatory diseases, all of which can put excessive strain on the median nerve and cause carpal tunnel syndrome. This finding is in agreement with a study by **Omole, et al., (2023)** who stated that overweight increased risk factors for carpal tunnel syndrome.

The current study revealed that there was a statistically significant difference in pre and postprograms regarding symptom severity among hand exercises while a high statistically significant difference in pre and post-program was found among the studied elderly patients in combined groups. This result may be due to the hand exercise interventions focusing on physical condition through improving venous return and decreasing pressure inside the carpal tunnel, while combined interventions worked at physical and psychological which is more effective on symptoms among them. This result was in harmony with **Talebi**, et al, (2018) & Awad, et al., (2022) who showed a significantly marked improvement in symptom severity among studied patients after applying manual intervention.

The result of the current study illustrated that there were significant improvements in mean scores of functional status of the hand exercise group. This finding may be due to hand exercises can alleviate symptoms by increasing venous return from the nerve bundles, lowering pressure inside the carpal tunnel, and stretching the adhesions in the carpal canal. This result is confirmed by a study done by **Shaheen & Mohamed**, (2021) who found that hand exercise is an effective way to improve the functional status scores.

The present study revealed that there is a significant difference among the studied groups on functional status and mindful attention awareness, while there is no significant difference in symptom severity in the mindfulness group only. This finding attributed to using adaptive coping techniques could help CTS sufferers feel less stressed, which would enhance their functional status. This explanation match with (Gurvich, et al., 2021 & Alsharif et al., 2022) who claims that exercise, mindfulness, deep breathing, and other adaptive coping mechanisms along with an optimistic mindset are helpful ways to lower stress and enhance physical and mental wellness. This finding agreed with a study by Abdolrazaghi, et al., (2023)entitled "Effectiveness of tendon and nerve gliding exercises in the treatment of patients with mild idiopathic carpal tunnel syndrome" and found that there was no statistically significant improvement in symptoms severity while there was a statistically significant improvement in functional status among studies groups. In addition to the study of Asal et al. (2024) that support the need for psychological interventions that address both perceived stress and coping strategies as a way to enhance the functioning status and quality of life of patients with CTS. This result validates the hypothesis that "Elderly Patients with carpal tunnel syndrome who receive hand exercise and mindfulness stress reduction intervention is

expected to be better than hand exercise only and mindfulness stress reduction intervention only group"

Moreover, this study revealed that there is a highly significant correlation between Symptom severity and Functional status. There is also a significant correlation between the five facets of mindfulness and Symptom severity, as well as between the five facets of mindfulness and Functional status. This finding agreement **Zafar**, (2021) who carried out "Level of Functional Impairment using Symptom Severity and Functional Status Scales in Patients with Carpal Tunnel Syndrome" and found that there is a strong correlation between symptom severity and functional severity scores.

As well as this study found a significant correlation between the five facets of mindfulness and symptom severity also, between the five facets of mindfulness and functional status. It can be explained by the way mindfulness influences the cognitive and emotive domains where pain is controlled, hence influencing the degree of pain and functional status. These findings are supported with the findings of (Lu, et al., 2023) who assert that mindfulness have been enhance attention and related behavioral responses including analgesia, which is discussed as an effective method in the context of pain interventions.

## Conclusion:

According to the results of this study, both hand exercise and mindfulness groups showed some improvement in symptom severity, functional status, and mindfulness awareness. However, the hand exercises and mindfulness intervention group offer additional benefits compared with hand exercise alone or mindfulness alone.

## **Recommendation:**

- Use combined hand exercise and mindfulness that assist with the improvement of functional status and mindfulness and decrease symptoms severity.
- Regular health education for elderly who are experiencing early-stage carpal tunnel syndrome.
- Periodic follow-up for the elderly to ensure understanding of health information.

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#### **Ethical Approval**

The Clinical Research Ethics Committee of Minia University approved the study

#### **Statement of Informed Consent**

Informed consent was obtained from all patients to be included in the study.

#### **Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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