## The Efficacy of Hand Exercise and Splinting on Carpal Tunnel Syndrome among Pregnant Women

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## Abstract

**Background:** Carpal tunnel syndrome has a critical effect on the pregnant women's quality of life. Several non-pharmacological techniques have been used to relieve these symptoms. The aim of this study: was to determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women. Subjects and Method: Quasi experimental research design was used to conduct this study at antenatal outpatient clinic of Tanta University, El-Menshawy and EL-Mabara Hospitals. The study sample consisted of 120 pregnant women with carpal tunnel syndrome. Data collection was conducted using three tools, Tool I: Women's knowledge structured interviewing questionnaire regarding carpal tunnel syndrome, Tool II: Boston Carpal Tunnel Syndrome Questionnaire and Tool III: Numeric pain rating scale. **Results:** There was a statistically significant improvement in the overall knowledge, severity of carpal tunnel syndrome, and level of pain after implementation of hand exercise and splinting. Additionally, there were positive correlation between the studied pregnant women's total score level of knowledge and their total Boston Carpal Tunnel Syndrome Questionnaire pre and post intervention, also there is a negative correlation between knowledge scores and Numeric Pain scores pre and post intervention. Conclusion: The findings of the present study revealed significant improvement in the overall knowledge, severity of carpal tunnel syndrome, and level of pain after implementation of the intervention. **Recommendation:** It is recommended to develop training programs for pregnant women in order to improve their knowledge and practices regarding carpal tunnel syndrome.

Key words: Hand Exercise, Splinting, Carpal Tunnel Syndrome, Pregnant Woman.

## Introduction:

The entrapment of the median nerve in the carpal tunnel of the wrist, usually accompanied by a rise in carpal tunnel pressure, is known as carpal tunnel syndrome. In the upper quadrant, it is the most common type of peripheral neuropathy. It significantly affects the women's pregnant day-to-day activities and lowers their ability for work, which has an impact on the overall health and quality of life of women (Obuchowicz, Kruszyńska, Strzelecki, & 2021) pregnancytunnel syndrome related carpal (PRCTS), also referred to as CTS, can occur in between 0.23% and 70% of cases (Soad, Manal, & Raga, 2020).

Carpal tunnel syndrome affects about 4% of adults in the general population and 8% of adults who work. Third trimesters (63%), second trimester (26%), and first trimester (11%), are the most likely times for CTS to occur (Cimpeanu et al., 2024; Boehrer, 2020; Gabrielli, Lesiak, & Fowler, 2020). Genetic predisposition, history of repetitive wrist movements from typing, repetitive use, or machine work, obesity, diabetes, cumulative trauma disorders. tumors, hypothyroidism, fractures to the wrist autoimmune disorders like spine, rheumatoid arthritis, and pregnancy are the most common causes of carpal tunnel syndrome (Justin, 2023).

Hormonal changes during pregnancy generally result in edema in several body areas, including the wrists. Fluid accumulation in the carpal tunnel may exert pressure on the median nerve. Carpal tunnel syndrome results from the compression of the median nerve. (Ghoraba, Morsy, & Abo El-Enin, 2021). Those who work assembly-line jobs, such as manufacturing, sewing, finishing, and cleaning, as well as packing meat, poultry, or fish, are particularly susceptible to acquiring CTS (Nowak et al., 2023). The tingling or numbness in the hands is the first sign of CTS. Particularly affected by these symptoms are the radial faces of the middle, ring, and index fingers; moreover, the palmar faces of the thumb and second finger. The palm does not experience these symptoms. This is because, prior to entering the tunnel, the branches of the median nerve that innervate the palms are divided (Secorun et al., 2021).

Paresthesia, which includes burning, tingling, and numbness, appears early in the sleeping phase but later in the day in CTS women. Hand-made activations (knitting, cleaning dishes) cause pain and paresthesia during the day. The compression of the median nerve in one or both wrists causes pain, tingling, numbness, and weakness in women with CTS. Shaking the hand may help relieve it; it is frequently

worse at night, especially in the first three fingers, disrupting sleep. It might cause a decline in hand function and grip strength (Shikha, & Biswas, 2024; Erickson et al., 2019). A complete history, clinical assessments, and diagnostic procedures like X-rays, Electromyograms nerve testing, (EMGs), and nerve conduction investigations are necessary for the diagnosis (Dabbagh, of CTS MacDermid, Yong, Macedo. & Packham, 2020).

In order to prevent irreversible damage median the nerve. chronic to symptoms, and lifelong disability, early diagnosis and treatment are crucial. Women with CTS have several treatment options based on a number of variables, including the disease's stage, the patient's preferences, and the intensity of the symptoms. Improving hand function and symptom relief are the main objectives of CTS treatment (Atroshi, Tadjerbashi, McCabe, & Ranstam, 2019). Since conservative therapy methods have a good chance of improving throughout the postpartum period, they are typically employed as the first line of treatment for mild-tomoderate instances of CTS. Education for women, employment modifications or changes, hand exercises, wrist splinting, B vitamins, non-steroidal anti-inflammatory drugs, and steroid injections are all part of it. Women with severe CTS and those whose conservative treatment options have failed are treated surgically (**Keskin et al., 2020**).

Immobilizing the wrist in a neutral posture to reduce its range of flexion or extension is the initial line of The justification for treatment. immobilizing the wrist to alleviate CTS symptoms is that it maintains the wrist in a neutral anatomical position, when the carpal tunnel is at its broadest, therefore reducing pressure on the carpal tunnel. Our method involves using a neutral wrist splint that has a metal bar inside to keep the wrist from moving up, down, or side to side while preserving finger mobility. Splinting allows mild to moderate nerve injury to recover by providing a respite to the median nerve and reducing edema but doing daily tasks while wearing a splint all day is difficult. It might be advised to wear it both throughout the day and while you sleep (Unal, Umay, & Akyuz, 2023; Nadar Alotaibi, & Manee, 2023; Osiak Elnazir, Walocha, & Pasternaket, 2022; Gatheridge, 2020).

Gliding exercises reduce teno-synovial edema, enhance venous return, prevent or stretch tendon-median nerve adhesions, and alleviate symptoms by lowering pressure within the carpal tunnel. To glide a tendon, the exercises essentially comprise a series of finger movements, and to glide the median nerve, they entail movements of the wrist and fingers. Each exercise was to be performed by women three to five times a day, with 10 repetitions for each. Five seconds were allowed for each position to hold (Gasnick, 2023; Malature 2022)

## **McIntyre**, 2022).

Nurses play a crucial role in improving the functional status and lessen CTS symptoms. The nurse should provide the women instructions on how to perform hand exercises that help reduce the symptoms of CTS and should warm their hands slightly before doing so. In order to support and immobilize the wrist at night, the nurse should also suggest that they use a night wrist splint (Abd Elmoniem, Abd-Elhakm, & Ibrahim, 2022). research evaluated Previous the educational intervention's effect on CTS and found that it was successful in reducing the intensity of symptoms and enhancing functional status (Ramadan, & Abdel Maksoud, 2021).

### Significance of the study

Pregnant women's musculoskeletal systems are directly impacted by the morphological changes that occur during this time. Pregnancy-related dynamic normal changes can lead to diseases of the musculoskeletal system. One of the most common problems during pregnancy is carpal tunnel syndrome. The quality of life for pregnant women is negatively impacted by untreated CTS. Damage to the median nerve can result in chronic discomfort, sleep disturbances, trouble with everyday tasks, and unproductive labor (Lewis et al., 2020; Oliveira, Bernardes, Santos & Dias, 2019). Aim of the study

The aim of this study was to determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women.

### **Research hypothesis**

The symptoms and severity of carpal tunnel syndrome will expected to be improved after implementation of the splinting and hand exercise.

### **Operational definition**

**Carpal tunnel syndrome**: It is a condition resulting from the compression of a nerve as it traverses the wrist into the hand, characterized mostly by weakness, discomfort, and sensory abnormalities in the hand and fingers.

## Subjects and Methods Research design

Quasi experimental research design was used to conduct this study.

#### Settings

This study was conducted at antenatal outpatient clinics of:

- Tanta University hospital affiliated to the Ministry of Higher Education and scientific research.
- El-Menshawy hospital affiliated to Ministry of Health and population.
- EL- Mabara Hospital affiliated to Health Insurance.

### Subjects

A purposive sample of 120 pregnant women with carpal tunnel syndrome was selected from the previously mentioned settings.

The participants in this study were chosen based on the subsequent inclusion criteria:

- Pregnant women between the ages of 18 and 35 years.
- Women in second and third trimester of the pregnancy.
- Women diagnosed with carpal tunnel syndrome (unilateral or bilateral).
- Women who are willing to participate in the study.

## **Exclusion criteria**

- Women had neurological problems.
- Women with physical disability.
- Women with hypothyroidism.
- Women with diabetes mellitus.
- Women with hand or wrist deformity.
- Previous carpal tunnel syndrome surgery.
- Women with rheumatoid arthritis.

The sample size was determined using the Epi-Info statistical program developed by the World Health Organization and the Centers for Disease Control and Prevention, Atlanta, Georgia, USA, version 2002.

- The criteria employed for sample size computation were as follows:
- 95% confidence interval.
- 80% statistical power of the study.
- Expected outcome 90% after intervention compared to 65% before intervention.

$$n = \frac{\left(\frac{z}{d}\right)^2 \times (0.50)^2}{1 + \frac{1}{N} \left[ \left(\frac{z}{d}\right)^2 \times (0.50)^2 - 1 \right]}$$

Where n represent the community size, Z denote the standard score corresponding to a significance level of 0.95, which is 1.96, and D signify the margin of error percentage.

## Tools of data collection:

To achieve the aim of this study, three tools were developed and used for data collection:

ToolI:Women'sknowledgestructuredinterviewingquestionnaireregardingcarpaltunnel syndrome:

It was designed by researchers following an assessment of recent pertinent literature. (Almajid et al., 2025; Abbas et al., 2024; Mirghani et al., 2024; Dwedar, ElShora, Ahmed, & El-Ansary, 2023) to gather fundamental data concerning the study participants. It comprised four components as outlined below:

### A.Socio-demographic

characteristics of the pregnant women: This section was designed to gather information regarding the general characteristics of the study sample, including age, current marital status, age at marriage, education, occupation, residence, telephone number, family income, and family type.

**B. Obstetrical history:** including gravidity, parity, last menstrual period, expected date of delivery, gestational weeks, timing of the initial antenatal visit, location of antenatal care, number of antenatal visits, participation in antenatal care classes, mode of previous delivery, and complications from previous pregnancies and deliveries.

# C. Medical history of carpal tunnel syndrome

- Previous history of carpal tunnel syndrome, previous management of carpal tunnel syndrome, previous use of resting hand support.
- -Current history of carpal tunnel syndrome to assess the characteristics of pain (location, quality, severity, timing and aggravating and alleviation measure of pain) and the hand swelling (location, timing and severity).

D. Pregnant women's knowledge regarding carpal tunnel syndrome:

This section was designed to evaluate women's understanding of carpal tunnel syndrome, including its definition, risk factors, signs and symptoms, complication, diagnostic tests, prevention, and therapeutic strategies.

The scoring system for women's knowledge was categorized as follows

- Correct and complete answers were scored as (2).
- Correct and incomplete answers were scored as (1).
- Incorrect and didn't know were scored as (0).

The total score level of women's knowledge was categorized as follows

- High level of knowledge  $\geq 75\%$
- Moderate level of knowledge 60 % <75%.

- Low level of knowledge <60%

## Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)

It was derived from Levine et al., (1993). It was utilized to evaluate the severity of carpal tunnel syndrome. The BCTQ has two distinct scales: the symptom severity scale and the functional scale. status Two questionnaires were administered using a five-point Likert scale, and were then completed post-intervention to assess the efficacy of splinting and hand exercises in alleviating symptoms

in pregnant women with carpal tunnel syndrome.

Part one : Symptom severity scale (SSS): It was consisted of eleven questions such as: severity of the wrist pain at night, number of the wake up at night due to wrist pain, severity of the during the wrist pain daytime, frequency of the wrist pain during the daytime, duration of the episode of pain during the daytime, numbness in the wrist, weakness in the wrist, tingling sensations in the wrist. severity of numbness or tingling at night, number of the wake up at night due to numbness or tingling and ability of the grasping or use of small objects such as keys or pen.

Each question has five answers numbered from 1 to 5, arranged according the severity of symptoms.

- No symptoms= 1
- Mild symptoms =2
- Moderate symptoms =3
- Intense symptoms = 4,
- Severe symptoms =5.

**Part two: Function status scale** (**FSS**): It was utilized to assess women's capacity to execute daily living activities. It comprises eight tasks, including writing, buttoning clothing, holding a book while reading, clutching a telephone receiver, opening jars, performing household chores, carrying a supermarket basket, and washing and dressing. Each question features five responses, numbered from 1 to 5, organized according to the capacity to execute everyday life activities:

- No difficulty =1,
- Little difficulty= 2,
- Moderate difficulty=3,
- Intense difficulty=4,
- Cannot perform the activity=5.

# Tool III: Numeric Pain Rating Scale (NPRS)

It was adopted from (McCaffery, & Beebe, 1989). It was used to determine the severity of the wrist pain. The tool is a horizontal line with a number from zero to ten that represents the women's level of pain. On the scale from 0 to 10 women were asked to mark on point that best describes the level of pain.

# A scoring system of numeric pain rating scale

- Mild pain : from 1-3 cm,
- Moderate pain : from 4-6 cm
- Severe pain or worst pain: from 7-10 cm.



Numeric Pain Rating Scale

## Method

**1. Official endorsement:** To validate the study's legitimacy, an official correspondence detailing the study's objectives was procured from the dean of the Faculty of Nursing at Tanta University and presented to the administrators of the obstetric department at three institutions (Tanta University Hospital, El-Menshawy Hospital, and El-Mabara Hospital) to secure their consent and collaboration for the study's execution.

- 2. Ethical considerations: including the preservation of privacy, confidentiality of acquired data, the participants' right to withdraw from the study at any time, and the exclusive use of data for the current meticulously study, were addressed throughout the research. Additionally, securing Ethical approval from the Scientific **Research Ethical Committee of the** Faculty of Nursing at Tanta University before to commencing the project (Ethical Code: 335 -11-2023).
- **3.** The study tool I was developed by the researcher after reviewing recent literature (Almajid et al., 2025; Abbas et al., 2024; Mirghani et al., 2024; Dwedar, ElShora, Ahmed, & El-Ansary, 2023), and tools (II and III) were adopted from (Levine et al., 1993; McCaffery, & Beebe, **1989**) respectively after reviewing recent literature.

# 4. Validity and reliability of the study tools

The face and content validity of the study tools were assessed through a jury test conducted by five experts in the field of Maternal and Neonatal Health Nursing. This evaluation aimed to determine the relevance and appropriateness of both individual items and the entire instrument in measuring the desired outcomes. The questionnaire's face validity was determined to be 92.17% based on expert opinions, while the content validity index (%) for its items was 82.9% for knowledge, 91.50% for Boston carpal tunnel syndrome questionnaire, and 87.7% for numeric pain rating scale. In terms of reliability, the questionnaire was tested among pilot subjects, and Cronbach's Alpha coefficients were calculated. The values obtained were 0.830 for knowledge, 0.841 for boston carpal tunnel syndrome questionnaire, and 0.813% for numeric pain rating scale.

5. A pilot research was done on 10% of the sample (12 pregnant women) from the specified conditions prior to the real data collection. This pilot study sought to evaluate the feasibility and applicability of the research instruments, as well as to assess the time necessary for their

completion. The data obtained from the pilot study and participants were incorporated into the final study sample, since no substantial alterations or modifications were made to the instruments.

6. Researchers attended a training program on acupressure for 3 days (18 hours) at Department of Physical Medicine, Tanta University.

## 7. Data collection

- Individual face-to-face interviews were conducted with each pregnant woman throughout the morning shifts until the target sample size was achieved. All pregnant women carpal diagnosed with tunnel syndrome at the time of data collection and meeting the specified inclusion criteria from the aforementioned settings were incorporated into the study. The data collection period for this study took place from December 2023 to the beginning of June 2024. The researchers visited the previous selected settings 3 days/week until the predetermined sample size was achieved.
- The data was collected according to the following phases

## A. Assessment phase

- This period occurred prior to any intervention, including hand exercises and splinting. Women were solicited to participate in the study following an explanation of its goal. A pre-test structured questionnaire was administered individually to each lady at the outset through an interview lasting 10 to 15 minutes each participant.

- The researcher utilized a tool. I: Questionnaire on Women's Knowledge of Carpal Tunnel Syndrome: Part 1: Sociodemographic Characteristics of the Pregnant Women Studied; Part 2: Obstetric History of the Women; Part 3: Medical History of Carpal Tunnel Syndrome.
- Tool (I) Part (4): The knowledge of pregnant women concerning carpal tunnel syndrome was evaluated to determine their understanding before and after the intervention, which included splinting and hand exercises.
- Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ): Part one: Symptom Severity Scale (SSS) and Part two: Functional Status Scale (FSS) were utilized to assess the impact of splinting and hand exercises on alleviating symptoms in pregnant women with carpal tunnel syndrome.
- Tool III: Numeric Pain Rating Scale was employed to assess the intensity of wrist pain.

#### **B.** Planning phase

a. Setting the goals and objectives of the intervention

### The goal of the intervention was to:

- Determine the efficacy of hand exercise and splinting on carpal tunnel syndrome among pregnant women.

## **Objectives of the program**

- Reduce the symptoms and severity of carpal tunnel syndrome.
- Improve the pregnant women's health status.

# Preparation of the content of the booklet

The content of the educational booklet was developed by the researchers and distributed to the women to increase their knowledge and quality their skills to deal with carpal tunnel syndrome. Various teaching methods, power-point, demonstrations and redemonstrations, were prepared for the women, along with instructional materials included infographics to be used during the sessions of training.

## C. Implementation phase

The subjects were divided into 20 groups (each group about 6 pregnant women) to receive the session of training. This division's goal is to give each group the right amount of time to complete the training. The researchers give information about carpal tunnel syndrome (definition, risk factors, signs and symptoms, complication, diagnostic test, prevention and management) and applied the technique of hand exercise and splinting.

## Hand exercise

- The researchers deliver vocal instructions regarding the types of exercises, their significance, and safety measures for duration of 20 to 30 minutes.
- A colored pamphlet was handed to all ladies. It was composed in straightforward Arabic and enhanced with photographs and pictures.
- The researchers exhibit hand exercises and prompt the women to replicate them until the researchers ascertain that the women have mastered the necessary skills.

# 1. Wrist bend: (forward and back)

- Position the elbow on a table with the arm elevated and the wrist aligned. Gradually flex the wrist forward to a right angle and maintain this position for 5 seconds. Subsequently, extend the wrist and then gently flex it backward, holding for another 5 seconds. Perform 3 sets of 10 repetitions.



AmericanAcademyofOrthopedicSurgeons.(2018).Therapeuticexerciseprogram forcarpal tunnelsyndrome.

### 2. Wrist lift

- Position one palm on the table and elevate the fingers, then position the other hand across the knuckles at a 90-degree angle and apply downward pressure as the lower hand attempts to pull upward. Exchange hands and repeat the process.



American Academy of OrthopedicSurgeons.(2018).*Exercise program for carpal tunnel*syndrome.

### 3. Wrist flex

- Maintain the arm extended forward with the palm oriented downward, slowly flex the wrist downward, employing the opposite hand to apply pressure on the stretching hand towards the body, and sustain this position for 15-30 seconds, then extend the wrist. Carefully extend the stretched hand posteriorly and utilize the contralateral hand to retract the fingers, maintaining this position for 15-30 seconds and performing 3 sets for each wrist.



American Academy of OrthopedicSurgeons.(2018).*Exercise program for carpal tunnel*syndrome.

- 4. Finger bend
- Begin with the fingers extended straight, then gently flex the middle joints of the fingers downward toward the upper palm, maintaining this position for 5 seconds. Perform 3 sets of 10 repetitions.



**AmericanAcademy of Orthopedic Surgeons.** (2018). *Therapeutic exercise program for carpal tunnel syndrome*.

**5. Hand squeeze**Squeeze a rubber ball and hold for 5 seconds and do 3 sets of 10 repetitions.



American Academy of OrthopedicSurgeons.(2018).*Exercise program for carpal tunnel syndrome.* 

#### 6.Median nerve gliding exercises.

- Start with the wrist in a neutral alignment, fingers and thumb curled

into a fist, with the thumb directed towards the woman. Extend the fingers and thumb into a straight, neutral posture, maintaining their alignment. Bend the wrist so that the palm faces upwards, preserving the hand's position. Extend the thumb away from the hand, keeping the hand and fingers stationary. Rotate the wrist so that the palm faces away from the woman. While in this position, gently pull down on the thumb with the opposite hand. Maintain each position for 5 seconds and repeat the series 3 to 5 times.



Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022). Comparison of two manual therapy protocols, incorporating tendon gliding exercises as a shared adjunct, in the treatment of individuals with persistent carpal tunnel syndrome. Pain Research and Management, (1), 1975803

Hand splinting: Keep the wrist in a neutral position and then apply the hand splinting.



Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022). Comparison of two manual therapy protocols, incorporating tendon gliding exercises as a shared adjunct, in the treatment of individuals with persistent carpal tunnel syndrome. Pain Research and Management (1), 1975803.

#### **D.** Evaluation Phase (posttest)

- Women with carpal tunnel syndrome re-assessed again after performed hand exercise and applying splint by using tool I part (4): Pregnant women's knowledge regarding carpal tunnel syndrome
- Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) to assess the impact of nocturnal splinting and hand exercises on alleviating symptoms in pregnant women with carpal tunnel syndrome.
- The severity of the wrist pain was assessed by using tool III: Numeric pain rating scale.

#### Statistical analysis

- Data Analysis: The collected data underwent a comprehensive analysis process. This involved coding, entry into a database, tabulation, and statistical analysis utilizing SPSS software (version 25).
- Quantitative data were summarized using range, mean, and standard deviation calculations. Qualitative data, characterized by categorical variables expressed as frequencies, percentages, or proportions, were compared between two or more groups using the Chi-square test.
- For comparison between related more than two means of nonparametric data (before intervention, the end of 1<sup>st</sup> week after delivery and at the end of the postpartum period), Friedman Test (x<sup>2</sup> value) was calculated.
- For non-parametric data from independent samples, comparison of means between two groups was conducted using the Mann-Whitney U test (Z value). When comparing means across three or more groups, the Kruskal-Wallis test (Chi-square value) was employed. Correlation analysis between variables was performed using Pearson's correlation coefficient (r).

#### Results

Table (1): Distribution of the studied women according to their sociodemographic characteristics. The table revealed that nearly half of the studied women (45.0%) were aged from 25 to 30 with a mean age  $\pm$  SD =27.4±4.12 and most of them (93.3%) were married. One half of the studied women (50.0%) married at the age 30-35. The table also revealed that more than half of the studied women (53.3%) had a secondary school education and three fifths of them (80.0%) were housewives. It also noticed that nearly three quarters of them (71.7%) were from urban area and 63.3% belong to extended families.

Table (2): Distribution of the studied women according to their obstetric The table history. presents an overview of the obstetrical history of the studied women. Among the notable findings, 45.0% had a gravidity of three, 41.7% had a parity of two, and antenatal 86.7% attended care. Regarding the mode of previous delivery, 79.1% underwent Cesarean section, and 20.0% reported previous pregnancy complications, with preeclampsia and placenta previa being the most common. Additionally, 9.3% complications experienced during previous deliveries, including uterine prolapse, fetal distress, and umbilical cord prolapse.

Table (3): Distribution of the studied women according to their medical history of carpal tunnel syndrome. This table outlines the medical history of carpal tunnel syndrome among the studied women. Notably, 13.3% reported a previous history of carpal tunnel syndrome, with 37.5% of them having received previous management. The pain was predominantly located in the left hand (53.3%), and 58.3% experienced radiating pain. Nighttime was the most common timing for both pains (50.0%) and hand swelling (58.3%). The severity of pain was mainly moderate (58.3%), while hand swelling varied, with 58.3% having moderate severity. This information provides insights into the prevalence and characteristics of carpal tunnel syndrome in the studied population.

Table (4): Distribution of the studied women according to their knowledge regarding carpal tunnel syndrome. The table demonstrates a substantial improvement in pregnant women's knowledge about carpal tunnel syndrome post-intervention. Before the intervention, a significant percentage had incorrect or incomplete knowledge across various aspects of carpal tunnel syndrome. Postintervention, there was a remarkable increase in correct and complete

knowledge. leading highly to significant chi-square values for each knowledge domain (P<0.001\*). This emphasizes the effectiveness of the intervention in enhancing pregnant women's understanding of carpal syndrome, tunnel covering its definition, risk factors, signs and symptoms, complications, diagnostic prevention, tests. and medical management.

Figure (1): Distribution of the studied women according to their total knowledge scores regarding carpal tunnel syndrome. The figure illustrated a significant improvement in knowledge levels about carpal tunnel syndrome following the intervention. Prior to the intervention, the majority had low knowledge (93.3%), but after the intervention, a substantial increase was observed, with 83.3% exhibiting high knowledge. The mean knowledge score increased from 3.14±1.25 to  $18.33 \pm 1.75$ , indicating the effectiveness of the intervention in enhancing understanding about carpal tunnel syndrome among the study participants. chi-square The test showed a highly significant association between the intervention and (X2=87.125, levels knowledge P<0.001\*).

Table (5): Distribution of the studiedwomen according to their symptomseverityscaleregardingcarpal

**tunnel syndrome pre intervention.** Table displays the studied women according to their symptom severity scale regarding carpal tunnel syndrome pre intervention. The table indicated that pre-intervention show highest percentages in nighttime pain, daytime pain, numbness and tingling and difficulty with the grasping and use of small objects.

Table (6): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention. Table displays the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention. The table indicated that post-intervention show highest percentages in substantial improvement nighttime in pain (43.3%), notable reduction in daytime pain (45.0%), significant alleviation of numbness and tingling (43.3%), and remarkable enhancement in grasping use (38.3%), object and small highlighting notable positive effects of the intervention

Table (7): Distribution of the studiedwomenaccordingtoFunctional Improvement in CarpalTunnel Syndrome Preand Post-Intervention.The table shows thatpost-interventionassessmentdemonstrated statistically significantimprovements in various functional

activities, including writing (43.3% difficulty), buttoning without of clothes (36.7% without difficulty), holding a book while reading (33.3% difficulty), without gripping a telephone handle (35.0% without difficulty), opening jars (38.3%) without difficulty), household chores (41.7% without difficulty), carrying a basket (40.0%) without grocery difficulty), and bathing/dressing (38.3% without difficulty), indicating the effectiveness of the intervention in enhancing functional abilities in patients with carpal tunnel syndrome.

Figure (2): Distribution of the studied women according to their total Boston Carpal Tunnel Syndrome Scores Pre and Post-Intervention. The figure showed significantly improved the Function Status Scale scores post intervention compared to pre intervention (Preintervention mean:  $38.45 \pm 4.26$ , postintervention mean:  $12.54 \pm 2.78$ , t = 55.797, P < 0.001\*), Symptom Severity Scale scores (Pre-intervention mean:  $27.40 \pm 3.19$ , post-intervention mean:  $4.87 \pm 1.66$ , t = 68.632, P < 0.001\*), and Total Boston Carpal Tunnel Syndrome scores (Preintervention mean:  $62.30 \pm 5.78$ , postintervention mean:  $17.46 \pm 2.42$ , t = 78.389,  $P < 0.001^*$ ), highlighting the effectiveness of the intervention in severity reducing symptom and

improving functional status in patients with carpal tunnel syndrome.

Figure (3): Distribution of the studied women according to their total Numeric pain rating scale Pre and Post-Intervention. The figure displays that, the intervention led to a significant reduction in pain severity among pregnant women, as evidenced by the distribution shift in the Numeric Pain Rating Scale categories. The postintervention results show a substantial decrease in the "High" pain category (Pre-intervention: 80.0%. postintervention: 10.0%), accompanied by an increase in the "Mild" pain category (Pre-intervention: 8.3%. postintervention: 83.3%). The Chi-square test (X2 = 140.606, P <  $0.001^*$ ) confirms the statistically significant improvement in pain levels after the intervention.

Table (8): Correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre and Post-Intervention and Pre Post-Intervention. The table demonstrates correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre and Post-Intervention. The correlation analysis reveals significant associations among knowledge scores, Boston scores, and Numeric Pain scores in carpal tunnel syndrome patients both before and after the intervention. Pre-intervention, there is

negative correlation between a knowledge scores and Numeric Pain scores (r = -0.812, P<  $0.001^*$ ), indicating that higher knowledge is associated with lower pain levels. post-intervention, Similarly, this negative correlation persists (r = - $0.230, P = 0.004^*$ ) alongside a negative correlation between Boston scores and Numeric Pain scores (r = 0.715, P< 0.001\*), suggesting that improved knowledge and lower Boston scores are associated with reduced pain severity. The correlations provide insights into the interplay between knowledge, clinical symptoms (Boston scores), and pain outcomes in the context of carpal tunnel syndrome.

Table (9): Relation between Socio demographic characteristic and **Boston Carpal Tunnel Syndrome** Pre and Post-Intervention. The table demonstrates relation between socio demographic characteristic and Boston Carpal Tunnel Syndrome Pre and Post-Intervention. The table presented a comprehensive relation of Boston Carpal Tunnel Syndrome scores across demographic various groups both after before and intervention. Significant differences are observed in Boston scores based on age groups, age at marriage, status, marital duration of current marriage, level of occupation, residence, education. family income, and type of family (all  $P < 0.001^*$ ). These findings suggest that demographic factors play a substantial role in influencing Boston scores, highlighting the need for a personalized approach in the of management carpal tunnel syndrome. The statistical tests (t-tests) provide evidence of significant variations in Boston scores within each demographic category, emphasizing importance the of considering demographic characteristics in the assessment and intervention strategies for carpal tunnel syndrome women.

Casia damagnankia akana stanisting	Studied women			
Socio-demographic characteristics	Ν	%		
Age		·		
18-	30	25.0		
25-	54	45.0		
30-35	36	30.0		
Range	1	8-35		
(Mean±SD)	27.4	4±4.12		
Marital status				
Married	112	93.3		
Divorced	6	5.0		
Widowed	2	1.7		
Age at marriage				
<20	12	10.0		
20-<30	48	40.0		
30 - 35	60	50.0		
Range	1	9-35		
(Mean±SD)	24.1	16±5.2		
Duration of current marriage				
Less than 5 years	30	25.0		
5-10 years	50	41.7		
More than 10 years	40	33.3		
Range	2	2-17		
(Mean±SD)	11.5	6±3.28		
Level of education				
Illiterate	10	8.3		
Read and Write	20	16.7		
Primary school	8	6.7		
Secondary school	64	53.3		
University	18	15.0		
Occupation				
Working	24	20.0		
House wife	96	80.0		
Residence				
Urban	86	71.7		
Rural	34	28.3		
Family income from women view				
More than enough	2	1.7		
Enough	78	65.0		
Not enough	40	33.3		
Type of family				
Nuclear	44	36.7		
Extended	76	63.3		

Table (1): Distribution of the studied women according to their sociodemographic characteristics (n=120).

Obstatiziant bistomy of the women	Studied	l women
Obstetrical history of the women	Ν	%
Gravidity		
1	18	15.0
2	27	26.7
3	55	45.0
4 or more	20	13.3
Parity	0	0
0	34	28.3
1	26	21.7
2	50	41.7
3	10	8.3
Abortion	II.	Ш
Yes	28	23.4
No	92	76.6
Attendance of antenatal care	U	U
Yes	104	86.7
No	16	13.3
Gestational weeks	30.45	± 2.66
Place of antenatal care	0	0
Government hospital	56	46.7
Private hospital	12	10.0
Private clinic	30	25.0
Maternal and child health care	22	18.3
Number of antenatal care visits		
	30	25.0
2	54	45.0
3	30	25.0
	6	5.0
Node of previous delivery (n=	80)	20.0
Cesarean section	18 68	20.9 70.1
Previous pregnancy complications	00	79.1
Yes	24	20.0
No	96	80.0
If the answer is yes, mention the complications?	(n=24)	00.0
Pre-eclampsia	8	33.3
Placenta previa	10	41.7
PROM	6	25.0
Previous delivery complications (n=8	6)	
Yes	8	9.3
No	78	90.7
If the answer is yes, mention the complications?	(n=8)	
Uterine prolapse		25
Fetal distress	4	50
Umbilical cord prolapse	2	25

## Table (2): Distribution of the studied women according to their obstetric history (N=120).

Table (3): Distribution of the studied women according to their medical history of carpal tunnel syndrome (N=120).

Medical history of compal tunnel syndrome	Studied women			
Medical instory of carpar tunnel syndrome	Ν	%		
Previous history of carpal tunnel syndrome				
Yes	16	13.3		
No	104	86.7		
<b>Previous management of carpal tunnel syndrome</b> (n=16)				
Yes	6	37.5		
No	10	62.5		
If the answer is yes, mention (n=6)				
Medication	2	33.3		
Exercise	0	0.0		
Splint	4	66.7		
Surgery	0	0.0		
All of the above	0	0.0		
Assessment of the characteristics of the carpal tunnel syndrome pain				
Location				
Right hand	32	26.7		
Left hand	64	53.3		
Bilateral hand	24	20.0		
Severity of the pain				
Mild	18	15.0		
Moderate	70	58.3		
Severe	32	26.7		
Quality of the pain:				
Radiating	70	58.3		
Sharp	30	25.0		
Dull	20	16.7		
Timing of the pain				
Day	30	25.0		
Night	60	50.0		
Day and night	30	25.0		
Assessment of the severity of hand swelling:				
Location of the hand swelling				
Right hand	32	26.7		
Left hand	64	53.3		
Bilateral hand	24	20.0		
Timing of the hand swelling:				
Day	24	20.0		
Night	70	58.3		
Day and night	26	21.7		
Severity of the hand swelling:				
Mild	20	16.7		
Moderate	70	58.3		
Severe	30	25.0		

## Table (4): Distribution of the studied women according to their knowledge regarding carpal tunnel syndrome (N=120).

Pregnant women's knowledge	Pre intervention							Post intervention						Chi-square	
syndrome	Correct & complete		Correct & incomplete		Incorrect		Correct & complete		Correct & incomplete		Incorrect				
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	<b>X</b> <sup>2</sup>	P-value	
Definition	6	5.0	8	6.7	106	88.3	108	90.0	10	8.3	2	1.7	191.634	<0.001*	
Risk factors	8	6.7	4	3.3	108	90.0	96	80.0	16	13.3	8	6.7	167.868	<0.001*	
Signs and symptoms	4	3.3	6	5.0	110	91.7	102	85.0	12	10.0	6	5.0	185.845	<0.001*	
Complications	2	1.7	10	8.3	108	90.0	100	83.3	10	8.3	10	8.3	175.547	<0.001*	
Diagnostic test needed	10	8.3	12	10.0	98	81.7	106	88.3	8	6.7	6	5.0	161.633	<0.001*	
Prevention	4	3.3	14	11.7	102	85.0	98	81.7	12	10.0	10	8.3	162.353	<0.001*	
Medical management	6	5.0	6	5.0	108	90.0	94	78.3	14	11.7	12	10. 0	157.440	<0.001*	

\*Statistically significant (P<0.05)



Figure (1): Distribution of the studied women according to their total knowledge scores regarding carpal tunnel syndrome.

# Table (5): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome Pre Intervention (N=120).

Symptom severity scale	Don't	have	Milo	1	Mode	rate	Severe	e pain.	Very s	severe	
	pain	r	pain	<b>.</b>	pain.	r		r	pain		
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	
<b>1.</b> How severe is the hand or wrist	pain that	t you hav	ve at n	ight?							
	0	0.0	6	5.0	24	20.0	38	31.7	52	43.3	
2. Do you typically have pain in yo	ur hand	or wrist	durin	g the da	ytime?						
	0	0.0	8	6.7	12	10.0	50	41.7	50	41.7	
3. Do you have numbness (loss of s	ensation)	) in your	hand	?	•			r			
	8	6.7	14	11.7	52	43.3	26	21.7	20	16.7	
4. Do you have weakness in your h	and or w	rist?			•			r			
	16	6.7	30	25.0	38	31.7	36	30.0	8	6.7	
5. Do you have tingling sensations	in your h	and?			•			r			
	4	3.3	26	21.7	40	33.3	36	30.0	22	18.3	
6. How severe is numbness (loss of	sensation	n) or ting	gling a	t night?	?	1		1			
	0	0.0	26	21.7	32	26.7	28	23.3	30	25.0	
7. Do you have difficulty with the grasping and use of small objects such as keys or pens?											
	0	0.0	14	11.7	46	38.3	34	28.3	26	21.7	
	Never		Onc	e	2 or 3 t	times	4 or 5 t	times	More	than 5	
									times		
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	
8. How often did hand or wrist pai	n wake y	ou up du	iring a	a typica	l night i	n the past	two wee	eks?	-	-	
	0	0.0	30	25.0	32	26.7	28	23.3	30	25.0	
9. How often did hand numbness o	r tingling	g wake y	ou up	during	a typica	l night du	ring the	past two	weeks?		
	4	3.3	24	20.0	34	28.3	28	23.3	30	25.0	
	Never		Onc	e or	Three	to five	More	than 5	The p	pain is	
			twic	e a	times a	ı day	times a	day	consta	nt	
			day								
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	
10. How often do you have hand or	wrist pai	n during	g the d	laytime?	?						
	4	3.3	22	18.3	24	20.0	44	36.7	26	21.7	
	I neve	er get	Less	than	10 t	to 60	Greate	r than	Pain	is	
	pain	during	10		minute	es	60 min	utes	consta	nt	
	the day		minu	utes					throug	hout	
									day		
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%	
11. How long, on average, does an e	pisode of	pain las	t duri	ng the							
daytime?											
	6	5.0	22	18.3	42	35.0	28	23.3	22	18.3	

Table (6): Distribution of the studied women according to their symptom severity scale regarding carpal tunnel syndrome post intervention (N=120).

Symptom severity scale	Don't h	ave pain	Mild pain.		Moderate		Severe pain.		Very severe	
	N	0/	N	0/	pain.	0/	N	0/	pain N	0/
1 How covers is the hand on whist no	IN in that wa	70	N night?	70	IN	70	IN	70	IN	70
1. How severe is the hand of wrist pa	m that yo	A 2 3		31.7	4	2.2	10	83	16	13.3
2 Do you typically have pain in your	52 band or y	43.3 wrist duri	JO ng the d	J1./ dovtime?	, <del>4</del>	5.5	10	0.3	10	15.5
2. Do you typicany nave pair in your	54			83	40	33.3	4	33	12	10.0
3 Do you have numbness (loss of sen	sation) in	vour hand	10	0.5	40	55.5	-	5.5	14	10.0
	22	18.3	32	26.7	66	55.0	0	0.0	0	0.0
4. Do vou have weakness in your han	d or wrist	t?		2011	00		Ŭ	0.0	v	
	70	58.3	50	41.7	0	0.0	0	0.0	0	0.0
5. Do you have tingling sensations in	your han	d?								
	44	36.7	36	30.0	14	11.7	12	10.0	14	11.7
6. How severe is numbness (loss of se	nsation) o	or tingling	at nigh	nt?			8	1		
	44	36.7	36	30.0	18	15.0	12	10.0	10	8.3
7. Do you have difficulty with the gra	sping and	l use of sm	all obj	ects such	n as key	s or pens?				
	44	36.7	36	30.0	18	15.0	12	10.0	10	8.3
	Never	-	Once		2 or 3	times	4 or 5 ti	imes	More	than 5
									times	
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%
8. How often did hand or wrist pain v	vake you	up during	a typi	cal night	in the	past two w	eeks?			
	32	26.7	42	35.0	28	23.3	10	8.3	8	6.7
9. How often did hand numbness or t	ingling w	ake you uj	p durin	ig a typic	al nigh	t during t	he past tv	vo weeks?		
	10	10.0	76	63.3	24	20.0	0	0.0	8	6.7
	Never	<u>ų                                    </u>	Once	or	Three	e to five	More	than 5	The p	ain is
			twice	a day	times	a day	times a	day	constan	t
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%
10. How often do you have hand or wr	ist pain d	uring the	daytim	e?		1				
	22	18.3	32	26.7	66	55.0	0	0.0	0	0.0
	I never	get pain	Less	than	10	to 60	Greater	r than	Pain	is
	during t	the day	10 m	inutes	minut	tes	60 minu	ites	constan	t
									through	out
						-		-	day	
	Ν	%	Ν	%	Ν	%	Ν	%	Ν	%
11. How long, on average, does an of daytime?	episode o	f pain las	t duri	ng the						
	38	31.7	58	48.3	18	15.0	0	0.0	6	5.0

 Table (7): Distribution of the studied women according to their functional improvement in carpal tunnel syndrome pre and post-intervention (N=120).

Function status scale	No	difficulty	L diff	ittle iculty	Mo diff	derate iculty	Intense Cannot difficulty perform Cl		Chi-s	i-square		
	Ν	%	Ν	%	Ν	%	Ν	%	Ň	%	<b>X</b> <sup>2</sup>	<b>P-value</b>
1. Writing.												
Pre intervention	0	0.0	20	16.7	46	38.3	40	33.3	14	11.7		
Post intervention	52	43.3	30	25.0	26	21.7	12	10.0	0	0.0	88.632	< 0.001*
2. Buttoning of c	lothes	•										
Pre intervention	2	1.7	38	31.7	40	33.3	22	18.3	18	15.0		
Post intervention	44	36.7	38	31.7	24	20.0	14	11.7	0	0.0	62.126	< 0.001*
3. Holding a boo	k whil	e reading.										
Pre intervention	1	0.8	24	20.0	58	48.3	30	25.0	7	5.8		
Post intervention	40	33.3	42	35.0	22	18.3	12	10.0	4	3.3	66.739	< 0.001*
4. Gripping of a	teleph	one handle	2.									
Pre intervention	4	3.3	22	18.3	48	40.0	30	25.0	16	13.3		
Post intervention	42	35.0	40	33.3	20	16.7	14	11.7	4	3.3	61.165	< 0.001*
5. Opening of jar	s.											
Pre intervention	12	1.7	24	20.0	50	41.7	34	28.3	10	8.3		
Post intervention	46	38.3	32	30.0	18	15.0	16	13.3	4	3.3	44.532	< 0.001*
6. Household cho	ores.											
Pre intervention	6	5.0	22	18.3	44	36.7	36	30.0	12	10.0		
Post intervention	50	41.7	32	26.7	16	13.3	20	16.7	2	1.7	61.204	< 0.001*
7. Carrying of gr	ocery	basket.										
Pre intervention	0	0.0	28	23.3	44	36.7	28	23.3	20	16.7		
Post intervention	<b>48</b>	40.0	34	28.3	16	13.3	18	15.0	4	3.3	74.488	< 0.001*
8. Bathing and d	ressin	g.										
Pre intervention	0	0.0	32	26.7	38	31.7	28	23.3	22	18.3		
Post intervention	46	38.3	32	26.7	20	16.7	18	15.0	4	3.3	66.222	<0.001*



Figure (2): Distribution of the studied women according to their total Boston Carpal Tunnel Syndrome Scores Pre and Post-Intervention.



Figure (3): Distribution of the studied women according to their total Numeric pain rating scale Pre and Post-Intervention. Table (8): Correlation between total Knowledge Score, Boston Score, and Numeric Pain Pre andPost-Intervention Pre and Post-Intervention (N=120).

Correlation	Knowledg	ge score	Boston score		
Correlation	r	<b>P-value</b>	r	<b>P-value</b>	
Pre					
Boston score	-0.248	0.039*			
Numeric pain score	-0.812	< 0.001*	0.219	0.028*	
Post					
Boston score	-0.797	< 0.001*			
Numeric pain score	-0.230	0.004*	0.715	< 0.001*	

\*Statistically significant (P<0.05)

Table (9): Relation between Socio demographic characteristic and Boston Carpal Tunnel Syndrome Pre and Post-Intervention (N=120).

	Boston Carpal Tunnel Syndrome									
Relation	P	re	T	ests	Pos	st	Т	ests		
	Mean	SD	f/t	<b>P-value</b>	Mean	SD	f/t	<b>P-value</b>		
Age						-				
18-	46.03	5.06			17.73	5.02	75.219	<0.001*		
25-	54.15	9.18	72.303	< 0.001*	15.20	3.80				
30-35	68.81	7.75			7.31	1.85				
Marital status										
Married	59.29	11.27			12.25	4.95		<0.001*		
Divorced	45.81	9.50	13.872	<0.001*	16.56	5.70	11.678			
Widowed	49.50	5.28			18.67	5.69				
Age at marriage										
<20	48.22	6.33		<0.001*	17.16	4.54	78.234	<0.001*		
20-<30	53.79	8.66	79.098		15.32	3.72				
30 -35	68.21	8.50			7.83	2.17				
Duration of current marria	age									
Less than 5 years	46.03	5.06			17.73	5.02				
5-10 years	53.10	8.39	86.875	< 0.001*	15.52	3.76	76.180	< 0.001*		
More than 10 years	68.65	7.82			7.70	2.14				
Level of education						-				
Illiterate	42.60	2.37			18.20	4.96				
Read and Write	47.75	5.21			17.50	5.16				
Primary school	51.88	4.55	23.611	< 0.001*	16.13	3.44	19.439	< 0.001*		
Secondary school	58.05	11.00			13.09	4.62				
University	70.61	6.13			6.50	1.69				
Occupation										
Working	70.08	5.94	7.758	< 0.001*	6.79	1.64	10.581	< 0.001*		

House wife	53.13	10.27			15.14	4.91				
Residence										
Urban	60.41	11.27	6 701	<0.001*	1* 11.76	4.89	6.117	<0.001*		
Rural	46.68	5.38	0.791	<0.001	17.79	4.82				
Family income from women view										
More than enough	72.30	6.93			6.00	1.49				
Enough	59.05	10.87	36.540	< 0.001*	12.43	4.71	30.765	< 0.001*		
Not enough	46.92	5.37			17.67	4.71				
Type of family										
Nuclear	47.50	5.27	7 802	<0.001*	17.25	4.61	0.201	<0.001*		
Extended	61.74	11.26	1.892	<0.001*	11.28	4.87	9.391	<0.001*		

\*Statistically significant (P<0.05)

#### Discussion

Carpal tunnel syndrome (CTS) is a medical prevalent ailment that continues to be one of the most commonly reported types of the median nerve compression. It happens when the median nerve is pinched or constricted while passing through the wrist. The symptoms of the syndrome include tingling in the median nerve distribution, numbness, and hand pain. Compared to men, women are more likely to have CTS (Unal, Umay, & Akyuz, 2023). Improving hand functionality and reducing symptoms are the main goals of CTS treatment. Physicians treat CTS with both nonsurgical and surgical methods. Wrist splinting, hand exercises. shifting positions, taking medicine, and using non-vibrating equipment at work are examples of non-surgical treatments (Pourmokhtari, Mazrooyi, & Vosoughi, 2021).

The aim of the current study was to determine the efficacy of hand exercise

splinting carpal tunnel and on syndrome among pregnant women. The present study's sociodemographic features of the pregnant women under investigation revealed that, with a mean age of  $27.4 \pm 4.12$ , less than half of the women were between the ages of 25 and 30. Additionally, over three-quarters of the pregnant women in the study were married and over half of the expecting mothers had completed secondary school. indicating their level of education.

In relation to occupation, most of the studied pregnant women were housewife and less than three quarters of the study women come from urban area.

In terms of gravidity, fewer than half of the women in the study get pregnant three times. This finding is inappropriate with the finding of a study done by **Dwedar**, **ElShora**, **Ahmed**, & **El-Ansary** (2023) & Abd **Elmoniem**, **Abd-Elhakm**, & **Ibrahim** (2018) who said that nearly two-thirds became pregnant. Over two-fifths of them were having two births in terms of parity. Of them, less than threequarters had one or two children.

The majority of pregnant women were routine receiving antenatal care. according to antenatal care. Also, in the same line with Abd Elmoniem, Abd-Elhakm, & Ibrahim (2018) stated that more than three quarters received proper antenatal care. Additionally, this study showed that pregnant women's knowledge generally got better after the intervention in all items linked to their knowledge which include definition, risk factors, signs complications, and symptoms, prevention, diagnostic test, and medical management of CTS as compared to before intervention. While no prior study has explicitly assessed the impact of educational intervention addressing CTS on pregnant women's knowledge or health behavior. findings our demonstrate a lack of community awareness and the implementation of educational programs regarding CTS.

However, a literature review supported these findings, stating that education for women should include selfmanagement skills such as sleep positions that prevent excessive wrist bending and a home therapy program that includes splinting, stretching exercises, and heat treatment to relieve symptoms. Furthermore, it is recommended that pregnant women with CTS get conservative measures, reassurance, and adequate health education (Sevy, Sina, Varacallo, 2023; Genova, Dix et al., 2020).

Consequently, most of the women in our research had never had pregnancy problems before. This result aligns with **Dwedar, ElShora, Ahmed, & El-Ansary (2023)** who disclosed that over three-quarters of expectant mothers had never had pregnancy difficulties before.

The carpal tunnel syndrome symptom severity scale indicated a reduction in the severity of hand or wrist pain, nocturnal pain episodes, instances of pain. numbness, tingling. and difficulties with grasping following hand exercises and splinting This interventions. finding is consistent with Kokubo, & Kim ( 2021) ; Walker, Metzler, Cifu, & Swartz (2020) and Ahmed, & Khatab (2020) who asserted that hand exercises alleviate symptoms by preventing or stretching the adhesions between the tendons and median nerve, teno-synovial reducing edema. enhancing venous return, and reducing pressure within the carpal tunnel.

When it came to functional status, the majority of women had moderate trouble with writing, buttoning clothes, reading while holding a book, grasping

a phone handle, opening jars, doing household chores, carrying a shopping basket, bathing, and dressing pre intervention, and it enhanced after intervention. The functional status scale's overall score showed a strong correlation. According to **Unver, & Akyolcu (2018)**, hand and finger exercises with a ball are effective in reducing CTS symptoms and improving patients' functional status.

Similar findings were made bv Keskinet et al., (2020), who found that nerve and tendon-slip exercises were simple and efficient methods to enhance function and decrease the severity of CTS in pregnant women with mild to moderate symptoms during the second and third trimesters of pregnancy. Similar Abd to Elmoniem, Abd-Elhakm, & Ibrahim who examined (2018),how an educational program affected pregnant women's knowledge, the intensity of their symptoms, and their functional status, they discovered that physical activity and the use of a night splint during pregnancy helped the women's symptoms decrease.

Furthermore, **Ajroud, Younis, & Elzahaf (2020)** found that home physiotherapy is a conservative way to manage CTS symptoms during pregnancy. Along the same theme, in a randomized, placebo-controlled experiment, **Atroshi et al., (2019)**  showed that wrist splinting was examined as a conservative therapy method for CTS and provided evidence of hand splinting's efficacy in CTS patients.

According to the current study, the of majority pregnant women experienced mild pain after the intervention, while the majority experienced high discomfort before. CTS is often treated by splinting. Along with exercise, splinting as much possible throughout the day as improves quality of life, functioning, pain, and nocturnal symptoms Unal, Umay, & Akyuz (2023) and Sosic, Bojnec, Lonzaric, & JesensekPapez (2020). Also, exercises that strengthen the wrist's supporting muscles also enhance wrist health generally and may reduce pain associated with CTS Lewis et al., (2020).

In relation to the present study, there is significant statistically difference between Boston scores and Numeric Pain scores in carpal tunnel syndrome women both before and after the intervention. This result corresponds to Ahmed, & Khatab (2020)who discovered Boston scores and Numerical Pain scores in patients with carpal tunnel syndrome before and the intervention differed after statistically significantly.

### Conclusion

The results of the current study indicated that hand exercises and splinting helpful for are ways alleviating the symptoms of carpal tunnel syndrome. Additionally, a positive correlation was observed between the overall knowledge score of the studied pregnant women and the total Boston Carpal Tunnel Syndrome score, whereas a negative correlation existed between the overall knowledge score, the total Boston Carpal Tunnel Syndrome score, and the pain levels pre-intervention and both postintervention. Consequently, the research hypothesis was validated following the execution of hand exercises and splinting.

#### Recommendations

In light of the findings of the current investigation, the following recommendations are proposed:

- 1. Designing and implementing training programs for women with carpal tunnel syndrome to enhance, update, and refine their knowledge and skills.
- 2. Conduct replication of the study under varied conditions, incorporating bigger sample sizes and other contexts throughout Egypt, to ascertain the generalizability of the findings.

### References

Abbas, G., Ahmed, M., Almohannadi,
F., Elzawawi, K., Ahmed, A.,
Alsherawi, A., & Almohannadi, F.
(2024). Prevalence and Risk Factors

AssociatedWithCarpalTunnelSyndromeAmongSudaneseFemales:ACross-SectionalStudy.Cureus,16(11).DOI:10.7759/cureus.72943Volume

- Abd Elmoniem S., Abd-Elhakm E., & Ibrahim H. (2022). The Effect of an Educational Intervention about Carpal Tunnel Syndrome on Pregnant Women' Knowledge, Symptoms Severity, and Function Status. *IOSR Journal of Nursing and Health Science*, 14(1):1030-1041. DOI:10.21608/EJHC.2023.293038.
- Ahmed H., & Khatab H. (2020). The Effect of Night Splinting and Hand Exercise on Reducing the Symptoms in Patients with Carpal Tunnel Syndrome. *Egyptian Journal of Health Care*, *11*(4):615-633.
- Almajid, W., Alkhars, H., Alalwan, A., Albalawi. Т.. Alazzmi. Н., Alnougidan, H., & Alkhars, A. (2025). Awareness and knowledge of carpal tunnel syndrome in the Eastern province of Saudi Arabia. International Journal of Medicine in Developing Countries, 9(3), 647-647. 10.24911/IJMDC.51doi: 1739515537
- American Academy of OrthopaedicSurgeons.(2018).Exercise program for carpal tunnelsyndrome.
- Atroshi, I., Tadjerbashi, K., McCabe, S and Ranstam J. (2019). Treatment of

carpal tunnel syndrome with wrist splinting: study protocol for a randomized placebo-controlled trial. BMC Open Access. 20 (531),1-2. <u>https://doi.org/10.1186/</u> s13063-019-3635-6.

Boehrer R., (2020). Carpal tunnel syndrome and pregnancy go hand in hand.

https://utswmed.org/medblog/carpaltunnel-syndrome-pregnancy.

- Cimpeanu M., Roman N., Grigorescu S., Grigorescu O and Miclăus R. (2024). Management of "De Novo" Carpal Tunnel Syndrome in Pregnancy: A Narrative Review. *Journal of Personalized Medicine. 14* (240), 1-8. <u>https://doi</u>.org/10. 3390 /jpm14030240.
- Dabbagh, A., MacDermid C., Yong J., Macedo G., & Packham L. (2020).
  Diagnosing carpal tunnel syndrome: diagnostic test accuracy of scales, questionnaires, and hand symptom diagrams - a systematic review.
  Journal of Orthopedic & Sports Physical Therapy, 50(11): 622-631.
  https://www.jospt.org/doi/10.2519/jo spt.2020.9599
- Dwedar L., ElShora S., Ahmed A., and El-Ansary E. (2023). Effect of Nursing Instructional Program on Neurophysiologic Parameters of Carpal Tunnel Syndrome among Pregnant Women. *Egyptian Journal*

*of Health Care*, 14(1),1034-39. DOI: <u>10.21608/ejhc.2023.293038</u>

- Erickson M., Lawrence M., Stegink C., Coker D., Amadio P and Cleary C. (2019). Carpal Tunnel Syndrome: A Summary of Clinical Practice Guideline Recommendations-Using the Evidence to Guide Physical Practice. Therapist Journal of *Orthopedic Sports* **Physical** k DOI: Therapy.49, 359-60. 10.21608/asnj.2022 .164830.1434
- Gabrielli S., Lesiak C and Fowler R.(2020). The direct and indirect costs to society of Carpal tunnel release. 15:1-5.

https://doi.org/10.1177/155894471881 085

- Gasnick K. (2024). Carpal Tunnel Massage Techniques and Exercises. https://www.verywellhealth.com/car pal-tunnel-syndrome-massage-5095474
- Gatheridge M., Sholty E., Inman A., Pattillo M., Mindrup F and Sanderson D. (2020). Splinting in carpal tunnel syndrome: the optimal duration. *Military Medicine*. 185:2049-51. <u>https://doi.org/</u> 10.1093/milmed/usaa222.
- Genova A., Dix O., Saefan A., Thakur M., & Hassan A. (2020). Carpal Tunnel Syndrome: A Review of Literature. Cureus, 12(3):e7333. doi: 10.7759/cureus.7333.

Ghoraba D., Morsy M and Abo El-М. (2021).Enin Effect of Phonophoresis Carpal Tunnel on during Syndrome Pregnancy: А Randomized Clinical Trial. Medical Journal of Cairo University. 89(7). 2893-94. DOI:

10.21608/mjcu.2021.225222

- Justin O., Sina R and Varacallo M. (2023). Carpal Tunnel Syndrome. <u>https://www.ncbi.nlm.nih.gov/books/</u> <u>NBK448179</u>.
- Keskin Y., Kilic G., Taspinar O., Posul S., Halac G., Eren F., Erol E., Urkmez B and Aydin T. (2020). Effectiveness of home exercise in pregnant women with carpal tunnel syndrome: Randomized Control Trial. Journal of the Pakistan Medical Association.70(2);202-204.

https://doi.org/10.5455/JPMA.1846.

- Kokubo R., & Kim K. (2021). Carpal tunnel syndrome: diagnosis and treatment. *National Library of Medicine*, 49(6):1306-1316. https:// doi. org/10.11477/ mf.14362 04516.
- Levine, D., Simmons, B., Koris, M., Daltroy, L., Hohl, G., Fossel, A., & Katz, J. (1993). A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *JBJS*, 75(11), 1585-1592. DOI: 10.2106/ 00004623-199311000-00002

Lewis K., Coppieters M., Ross L., Hughes I., Vicenzino B., and Schmid A. (2020). Group education, night splinting and home exercises reduce conversion to surgery for carpal tunnel syndrome: a multicentre randomised trial. *Journal of physiotherapy*, 66(2), 97-104. DOI:

10.1016/j.jphys.2020.03.007

- McCaffery, M., & Beebe, A. (1989). Pain: Clinical manual for nursing practice.
- McIntyre K. (2022). Six exercises to help manage carpal tunnel syndrome. https://www.lifemark.ca/blog-post/6exercises-help-manage-carpal-tunnel syndrome.
- Mirghani, H., Aljohani, A., Alharbi, A.,
  Alatawi, B., Alanazi, F., Alzahrani,
  M., & Alhwiti, H. (2024). Prevalence
  and Awareness of Carpal Tunnel
  Syndrome Among Adults in Tabuk City
  of Saudi Arabia: A Cross-Sectional
  Study. *Cureus*, 16(2). DOI:
  10.7759/cureus.54076
- Nadar M., Alotaibi N and Manee F. (2023). Efficacy of splinting the wrist and metacarpophalangeal joints for the treatment of Carpal tunnel syndrome: an assessor-blinded randomized controlled trial. *BMJ* Open.13,1-2. doi:10. 1136/ bm jopen-2023-076961.
- NowakW.,ZnamirowskaP.,SzmigielskaN.,ZemstaK.,Miśkiewicz J.,Plata H.,Pałatyńska Mand Kulesza B. (2023).Risk factors for

carpal tunnel syndrome. Journal of Pre-Clinical and *Clinical Research*. 17(3).167.doi:10.26444/jpccr/ 168 559.

- Obuchowicz R., Kruszyńska J., & (2021). Classifying Strzelecki М. median nerves in carpal tunnel syndrome: Ultrasound image analysis. **Biocybernetics Biomedical** and Engineering, 41(2):335-351.https://doi.org/10.1016/j.bbe.202 1.02.01
- Oliveira G., Bernardes J., Santos E., & Dias A. (2019). Carpal tunnel syndrome during the third trimester of pregnancy: prevalence and risk factors. *Archives of gynecology and obstetrics*, 300(3): 623-631. https://doi.org/10.1007/s00404-019-05233-6.
- Osiak K., Elnazir P., Walocha A and Pasternak A. (2022). Carpal tunnel syndrome: state of the art review. Via Medica Journal, 81(4),851-62. DOI: 10.5603/FM.a2021.0121
- Pourmokhtari M., Mazrooyi M., & Vosoughi AR. (2021). Conservative or surgical treatment of carpal tunnel syndrome based on the severity and patient risk factors. *Musculoskeletal Surgery*, *105*(3):315–319. <u>https://doi.org/10.1007/</u> s12306-020-00663-x.
- RamadanShaheenS., & AbdelMaksoudMohamedM. (2021).EffectofNursingRehabilitation

Program on Symptoms Severity and Functional Status in Patients with Carpal Tunnel Syndrome Undergoing Surgery. *Egyptian Journal of Health Care, 12*(3), 1028-1046. Doi: 10.21608/ejhc.2021.193553.

- Secorun M., Cortes R., Garcia C., Sanz J., Ballan S., Alcober S., Moreno J and Lopez M. (2021). Effectiveness of Conservative Treatment According to Severity and Systemic Disease in Carpal Tunnel Syndrome: Α Systematic Review. International Journal of Environmental Research and Public *Health*.18,1-2. https://doi.org/10.3390/ijerph1805236 5.
- Sevy J., Sina R; &Varacallo M. (2023). Carpal Tunnel Syndrome. *National Library of Medicine*, Retrieved from https://www.ncbi.nlm.nih.gov/books/ NBK448179.
- Sheereen, F., Sarkar, B., Sahay, P., Shaphe, M., Alghadir, A., Iqbal, A., & Ahmad, F. (2022). Comparison of therapy two manual programs, including tendon gliding exercises as a common adjunct, while managing the participants with chronic carpal tunnel syndrome. Pain Research and Management, 2022(1), 1975803. DOI: 10.1155/2022/1975803
- Shikha L and Biswas A. (2024). A Comparative Study of Effectiveness of Splinting and Splinting Plus Local Corticosteroid Injection in Patients

with Carpal Tunnel syndrome: A Randomized Controlled Trial. Open Access Original Article. 16(1): e52868. DOI 10.7759/cureus.52868.

- Soad A.; Manal Y.; Raga E. (2020). An epidemiological study of carpal tunnel syndrome among pregnant women at Al-Wahda hospital Derna. *International Journal of Clinical Obstetrics and Gynecology*. 4, 30–33. DOI:10.33545/gynae.2020.v4.i1a.438
- Sosic L., Bojnec V., Lonzaric D., & JesensekPapez B. (2020). An advanced stage of carpal tunnel syndrome- is night-time splinting still effective? *International Journal of Occupational Medicine and Environmental Health*, 33(6):771-780. <u>https://doi.org /10.13075/ ijomeh.</u> 1896.016 11.
- Tsai C., Kuo H., Muo H., Chou W., & Lu Y. (2019). Characteristics of Traditional Chinese Medicine Use for Carpal Tunnel Syndrome. International Journal of Environmental Research and Public Health, 16(21), P. 4086. DOI: 10.3390/ijerph16214086
- Unal Z., Umay E., and Akyuz E. (2023). Splinting in carpal tunnel syndromeshould we use it during the daytime? *Egyptian Rheumatology and Rehabilitation*, 46-50. <u>https://doi.Org/10. 1186 /s43166-023-</u> <u>00214-9</u>.

- Unver S., & Akyolcu N. (2018). The Effect of Hand Exercise on Reducing Hemodialysis the Symptoms in Patients with Carpal Tunnel Syndrome, Asian Journal of Neurosurgery, 13(1), P. 31. doi: 10.4103/ajns.AJNS\_343\_16
- Walker C., Metzler M., Cifu X., & Swartz Z. (2020). Neutral wrist splinting in carpal tunnel syndrome: a comparison of night-only versus fulltime wear instructions. Archives of Physical Medicine and Rehabilitation, 81(4):424–429.

https://doi.org/10.1053/mr.2000.3856.