IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 7, Issue 6 Ver. X. (Nov.-Dec.2018), PP 19-28
www.iosrjournals.org

The Effect of an Educational Intervention about Carpal Tunnel Syndrome on Pregnant Women' Knowledge, Symptoms Severity, and Function Status

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Abstract:
Background: *The prevalence of carpal tunnel syndrome is high in pregnant women. All pregnant women should be investigated for hand and wrist complaints in routine antenatal follow-up to ensure good quality of life during pregnancy.*
Aim*: was to evaluate the effect of an educational intervention about carpal tunnel syndrome on the pregnant women' knowledge, symptoms severity, and function status.*
Methods*: Quasi-experimental design was utilized. The study was conducted at Obstetrics and Gynecology Outpatient Clinic, Benha University Hospital. A purposive sample of 100 pregnant women with carpal tunnel syndrome was included in the current study. Three tools were used for data collection; first tool; structured interview schedule including four parts: the subjects' demographic characteristics, obstetric history, current and past history of carpal tunnel syndrome and knowledge regarding CTS. Second tool: Boston carpal tunnel syndrome questionnaire, it composed of two scales; symptom severity scale and function status scale.* ***Third tool****: Visual pain analogue scale to assess the degree of pain.*
Results: *showed that 58.0% of the participants were aged from 30-40 years, with a mean age 30.68± 6.87 years, 78.0% of them were working, and 74% of them were overweight before pregnancy. There was general improvement (P< 0.000) after the intervention in the mean scores of the total knowledge, symptoms severity and function status as compared to before intervention. Furthermore, there were a positive, statistically significant correlation (P < 0.000) between studied pregnant women' symptoms severity scores and their function status pre and post intervention.*
Conclusion: *The implementation of an educational intervention about carpal tunnel syndrome was effective in improving pregnant women's knowledge regarding carpal tunnel syndrome, declining their carpal tunnel syndrome symptoms severity, and improving their function status.*
Recommendation*: Provide all pregnant women at antenatal clinics with a self-care guideline about CTS to improve their awareness.*
Keyword: *Carpal Tunnel Syndrome, Pregnant Women, Educational Intervention.*

Date of Submission: 05-12-2018 Date of acceptance: 21-12-2018

I. Introduction

Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy, which results from median nerve compression [1]. CTS occur in 4% of the general population and 10% of the working population [2]. CTS is frequent complication of pregnancy. Reported prevalence rates vary between 31 and 62% [3,4]. Carpal tunnel syndrome is named for the Greek word karpos meaning "wrist" and the narrow space where the median nerve passes between the bones of the wrist [5]. It commonly presents during the third trimester of pregnancy, but can occur during the first or second trimester [6].

The carpal tunnel is a small channel at the wrist, made up of bones covered by a tough, rigid, fibrous ligament. Passing through the tunnel are tendons and nerves which bend the wrist and fingers. A collection of fluid in the carpal tunnel will reduce the space even further and pressure builds up on the nerves causing pain, tingling and even numbness in the thumb and first two fingers [7].

According to Zyluk hormonal fluctuations, fluid accumulation with tendency to oedemas, nerve hypersensitivity and glucose level fluctuations are factors that predispose pregnant women to the development of CTS symptoms [8]. Probably because of the effect of the relaxin hormone which secreted by the placenta, pregnant women seem to be more susceptible to this condition than other [5]. Therefore, pregnant women with pre-eclampsia, hypertension, excess weight gain, and gestational diabetes are at increased risk of developing CTS. Breastfeeding may prolong recovery in women with pregnancy-related CTS [9].

Pregnancy is a period of various physiological and physical adaptations. During this process a lot of changes are confronted by the female body. Women often experience their first episode with CTS during pregnancy due to hormonal changes and water retention [10]. The swelling places pressure on the median nerve, compressing it and causing tingling and numbness in hands and fingers [11]. The prevalence of hand and wrist complaints is high in pregnant women. All pregnant women should be investigated for hand and wrist complaints in routine antenatal checks to ensure good life quality during pregnancy and for avoiding these complaints advancing to chronic state [12].

Carpal tunnel syndrome is diagnosed on the basis of the patient's present history and clinical findings. Symptoms involving the intermittent numbness of the thumb, index, long and radial half of the ring finger and usually occurs at night. During the early stage of the disease, patients may complain of numbness in the digits, nocturnal symptoms, or numbness experienced when holding a phone or newspaper [13,14]. During the physical exam, health care provider may use electrodiagnostic tests to confirm the diagnosis, if needed. Ectrodiagnostic tests use thin needles or electrodes (wires taped to the skin) to record and analyse signals nerves send and receive. Damage to the median nerve can slow down or block these electrical signals. Also Tinel's sign test used to identify nerve damage. During the test, lightly tap over the area with the affected nerve. If pregnant woman feel a tingling sensation, this can indicate nerve damage [15].

There are several therapeutic options for pregnant women with CTS depending on various factors, including the stage of the disease, the severity of the symptoms, and patients' preferences. Conservative treatment modalities are recommended as the first-line treatment, in cases of mild to moderate CTS [16]. Conservative treatment modalities used for the management of CTS are numerous and include night-time splinting, nerve and tendon gliding exercises, acupuncture, low-level laser, and ultrasound with or without phonophoresis [17]. The most effective self-care measures during pregnancy, night-time splinting that may help reduce increased pressure on the nerve that occurs when the wrist is bent; about 80% of women will notice reduction in symptoms with splinting alone [18,19]. Moreover, reducing activities that cause wrist to bend use cold therapy for about 10 minutes, several times a day, to help decrease swelling. Gentle grip-strengthening exercises which can help pump the fluid back out of the hands and elevate wrists as possible. According to Schub & Pravikoff, pregnant women with CTS are 3–4 times more likely than non-pregnant patients with CTS to respond to self-care measures [20].

1.2. Significance of the study

Carpal tunnel syndrome is commonly seen in pregnancy; it occurs in 4 % of the general population, but occurs in 31 to 62 % of pregnant women [4]. CTS usually happen in second trimester or third trimester. It can also continue, or develop, in the days after the birth of baby. CTS symptoms were negative effect on sleeping patterns during gestation. Sleep disturbances can be risk factors for a number of serious pregnancy-related sleep disorders; these include postpartum depression, pregnancy-induced hypertension, gestational diabetes, and intrauterine growth retardation [21]. Also, the pregnant women had difficult to doing certain everyday activities like washing up, knitting or even picking up small objects. And after birth, a woman with CTS may find it painful to hold her baby and breastfeed. To our knowledge, this is the first study that evaluates the effect of an educational intervention about carpal tunnel syndrome on pregnant women' knowledge, symptoms severity, and function status.

1.3. Aim of the study:

Evaluate the effect of an educational intervention about carpal tunnel syndrome on the pregnant women' knowledge, symptoms severity, and function status.

1.4. Research hypothesis

The pregnant women' knowledge, symptoms severity, and function status will be improved after implementation of an educational intervention about CTS.

II. Subjects and Methods

Study design: A quasi-experimental design.

Settings: The study was carried out at Obstetrics and Gynaecology Outpatient Clinic, Benha University Hospital.

Sampling:

Type: A purposive sample.

Size: This was a time based study of 6 months. 100 pregnant women with CTS were included in that period of time.

Inclusion and exclusion criteria: Primigravida and multigravida who were in the third trimester of their pregnancy, with clinical diagnosis of CTS both unilateral and bilateral based on history and physical

examination from the patient record, their age ≥25years, able to read and write, and she is willing to participate in the study. Otherwise those who having high risk pregnancy, other complications like hypothyroidism, diabetes which may lead to CTS, any other trauma related injuries, abnormal X-Ray of the wrist, and history of surgery or steroid injection into the carpal tunnel were excluded from the study.

Tools of data collection: Three tools were used in this study.

Tool I: A structured Interview Schedule:

It was designed by the researchers after reviewing a related literature; it was divided into four parts, written in simple Arabic language in the form of close and open-ended questions.

- Part I: Demographic characteristics of the studied pregnant women such as (age, residence, educational qualification, occupation, telephone number, and measurements of body mass index pre pregnancy).
- Part II: Past and current obstetric history (gravidity, parity, gestational weeks, and antenatal visits)
- Part III: Past and current history of CTS. The past history including (previous history of CTS, previous interventions as postural care, or use of resting hand support, previous family history), The current history pertaining (pain, location, severity and nature of pain, swelling in wrist and hand and alteration in sensation).
- Part IV: Knowledge of the studied pregnant women regarding CTS during pregnancy. This part was used before and after the intervention (pre/ post-test format). It included eight open ended questions which include (definition, causes, factors affecting CTS, symptoms, diagnosis, complications, prevention , self-care and management of CTS). Scoring system of knowledge: A correct answer scored (2), incomplete answer was scored (1) and the incorrect or unknown answer scored (zero). The knowledge score was calculated by adding the scores for the correct answers. The total possible score ranged from 0 to 16, means and standard deviations were calculated. The higher scores reflect higher levels of knowledge about CTS.

Tool II: Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)

A self-administered questionnaire for the assessment of severity of symptoms and function status in women who have CTS, it was adopted from Levine et al. [22]. All answers of the questionnaire concerned to the symptoms within a typical period of 24 hours, for the last two weeks. The BCTQ consists of two different scales: the Symptom Severity Scale (SSS, 11 items) and the Function Status Scale (FSS, 8 items). Both scales are answered on a five-point Likert scale, and used pre and post the intervention.

- **Part 1- Symptom Severity Scale (SSS):** Questions concerning symptoms severity scale are composed of 11 questions addressing: pain intensity during daytime and night time, time of pain during the day, dormancy, weakness, tingling sensation at night, frequency of that night tingling sensation, and skill. Each question has five answers numbered from 1 to 5, arranged in an increasing order of symptoms severity. Therefore, 1 means no symptoms, 2 mild symptoms, 3 moderate symptoms, 4 intense symptoms, and 5 severe symptoms. The total possible score ranged from 11 to 55, means and standard deviations were calculated. The higher scores reflect CTS symptoms severity.
- **Part 2- Function status scale (FSS):** FSS was used to measure patient's ability to perform activities of daily living. It consists of 8 items corresponds to a functional activity (writing, buttoning clothes, holding a book while reading, holding a telephone hang, housekeeping, opening a glass vial cap, carrying market bags, bathing and dressing). Each activity has five difficulty degrees, where degree 1 corresponds to no difficulty, 2 for little difficulty, 3 for moderate difficulty, 4 for intense difficulty, and 5 cannot perform the activity. The total possible score of the scale ranged from 8 to 40, means and standard deviations were calculated. The higher scores reflect function status difficulty due to hand or wrist symptoms.

Tool III: **Visual pain analogue scale**: It was adopted from Mc Caffery and Pasero [23] to assess the degree of pain. The tool is a horizontal line divided by number with equal distance. It ranged from 0 (no pain) to 10 (worst pain). mild pain (1,2), moderate (3,4), sever (5,6) very sever (7,8) and worst pain (9,10). Each degree of pain is explained with a picture for the associated facial expressions.

Tools Validity: The developed tools was reviewed for appropriateness of items through five an expert jury panel in the field of obstetrics and gynaecologic nursing and obstetrics Medicine , Neuro Medicine and physiotherapy specialty to assure content validity. The questionnaires were modified according to the panel judgment on clarity of sentences and appropriateness of content.

Tools Reliability: The reliability was done by Cronbach's Alpha coefficient test which revealed that each of the three tools consisted of relatively homogenous items as indicated by the moderate to high reliability of each tool. The internal consistency of knowledge was 0.82; while tool II and III were adopted with standardized validity and reliability.

Ethical considerations: All ethical issues were considered, participants were given explanations about the purpose of the study, and they were also informed that they could withdraw from the study at any time before the completion of the study. Participants who agreed to complete in this study were asked to sign a consent form. Confidentiality of participants' information was assured and the data were accessed only for research purpose.

Field work:

Approval: An official permission was obtained from both dean of Benha Faculty of Nursing and the Hospital authorities in the identified setting to collect the necessary data and implement the study.

The pilot study: The pilot study was conducted on 10% (10 pregnant women) for a period of two weeks to test the clarity and the applicability of the tool, find out the possible obstacles and problems that might face the researchers and interfere with data collection. The pilot study sample was included into the main study because no modification had been done in the tools of data collection.

Procedure:

The process of data collection was carried out in the period from beginning of March 2016 to end August 2016. The researchers attend the outpatient clinic for 6 months, three days / week from 9.00 AM to 12:00 PM. The pregnant women were selected during their antenatal follow up and after diagnosed by CTS with consideration to inclusion and exclusion criteria. The researchers introduced themselves to the women and explain the purpose of the study. After taking consent, general characteristics of the studied women and their knowledge regarding CTS were assessed using tool I. The severity of CTS symptoms and function status were also assessed using tool II. The degree of hand and rest pain was assessed using tool III. This phase took about 25 minutes. Based on the needs identified in the assessment phase from the pregnant women, and in view of the related literature, educational intervention was developed by the researchers in a form of printed Arabic guideline to satisfy the pregnant women knowledge deficit and self-care about CTS. The educational intervention involved two sessions. The first session for theoretical content which includes meaning of CTS, causes, risk factors, signs and symptoms, diagnosis, management methods, and preventive measures. Special attention was given to CTS with pregnancy. The second session for self-management techniques which include median nerve and tendon-gliding exercises training, and night splinting. The duration of each session lasted from 30 to 45 minutes including periods of discussion. Pregnant women were advised to do home exercise programme which includes median nerve and tendon-gliding exercises 5 times / day, alongside night splinting. Different teaching strategies were used such as lectures, group discussions, demonstrations and re-demonstrations. Suitable teaching media were used, included educational guideline that distributed to all pregnant women in the first day of the intervention. At the end of each session, the researchers set a date of the next visit. Finally: Evaluation phase: Two weeks after implementation of an educational intervention, the evaluation done by the same format of the pre-test to assess the impact of the implemented educational intervention.

Statistical Analysis:

The Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 and then the data were explored. Descriptive statistics and correlation coefficients were used to test the research hypothesis. Descriptive statistics (frequency, percentage, arithmetic mean, and standard deviation) were used to describe characteristics of the studied women. Qualitative variables were compared using a Fisher's Exact test (FET) as the tests of significance. Paired (t) test was used to compare between mean differences before and after the intervention. The p-value is the degree of significance. A statistically significant difference was considered at p-value ≤ 0.05.

III. Results

Table (1) clarifies demographic characteristics and obstetric history of the studied pregnant women. It was clear that 58.0% of the studied pregnant women were aged from 30-40 years, with a mean age 30.68± 6.87 years. Regarding pregnant women' educational qualification, 50.0% of them had university education. Moreover, 78.0% of them were working. In addition, 62.0% of the women were resident in urban areas. The mean BMI of them pre pregnancy were 27.23± 1.78. As regards their obstetric history, only 8.0% of them were primigravida, 70.0% of them were having 1-2 births, and 76.0% of them have a regular antenatal visits, finally the mean gestational age of them were 30.45± 2.66 weeks.

Fig. (1) portrays the distribution of the studied pregnant women according to their BMI pre pregnancy. It was found that only 26% of them were normal body weight, While 74% of them were overweight pre pregnancy**.**

Table (2) shows that (20.0%) of the studied pregnant women had a previous history of CTS, Among those who had a previous history of CTS, 60.0% and 70.0% of them had practiced previous postural care, and

used of resting hand support, respectively. As regard studied pregnant women present history, all of the women had wrist pain, 92.0% of them had swelling in wrist and hand, and 36.0% of them complain from altered sensation.

Fig. (2) displays the distribution of the studied pregnant women according to their CTS pain severity. It was clear that 70.0% of the studied pregnant women had moderate wrist and hand pain. Moreover, 22.0% of them had mild pain. Only 8.0% of them complain from severe pain.

Table (3) demonstrates that there were statistically significant differences (P< 0.05) pre and post intervention in relation to pregnant women' knowledge about meaning, causes, risk factors, symptoms, diagnosis, complication, prevention, and self-care measures of CTS.

Table (4) shows statistically significant improvement (P< 0.05) in all CTS symptom mean scores post the intervention, which include pain at night, waking up at night, pain during daytime, numbness, weakness, and tingling sensation in the hand, tingling waking up at night and difficulty grasping things.

Table (5) demonstrates that the function status of the studied pregnant women which include writing, buttoning of clothes, holding a book, gripping of a telephone handle, opening of jars, household chores, carrying of grocery bags, bathing and dressing were significantly improved (P< 0.05) post the intervention.

Table (6) portrays that, there were general improvement (P= 0.000) post the intervention in the mean scores of the total knowledge, symptoms severity and function status as compared to pre intervention.

Table (7) reflects that, there were a positive, statistically significant correlations (P = 0.000) between studied pregnant women' symptoms severity scores and their function status pre and post intervention.

Table (1) Percentage distribution of the studied pregnant women according to their demographic characteristics, and obstetric history (n = 100**)**

Characteristics	%	Mean ± SD
Age		30.68± 6.87 years
- 20-<30	42.0	
- 30-40	58.0	
Educational qualification		
- Read and write	4.0	
- Basic education	10.0	
- Secondary education	36.0	
- University education	50.0	
Occupation		
- Working	78.0	
- Housewife	22.0	
Residence		
- Rural	38.0	
- Urban	62.0	
Height (cm)		161.84±6.19 cm
weight (kg)		81.28± 7.41 kg
Body mass index pre pregnancy (BMI)		27.23± 1.78
Gravidity		
- Primigravida	8.0	
- Gravida (2)	64.0	
- Gravida (3) +	28.0	
Parity		
- Nullipara	8.0	
- Para (1-2)	70.0	
- Para (3) +	22.0	
Gestational weeks		30.45± 2.66 weeks
Antenatal visits		
- Regular	76.0	
- Irregular	24.0	

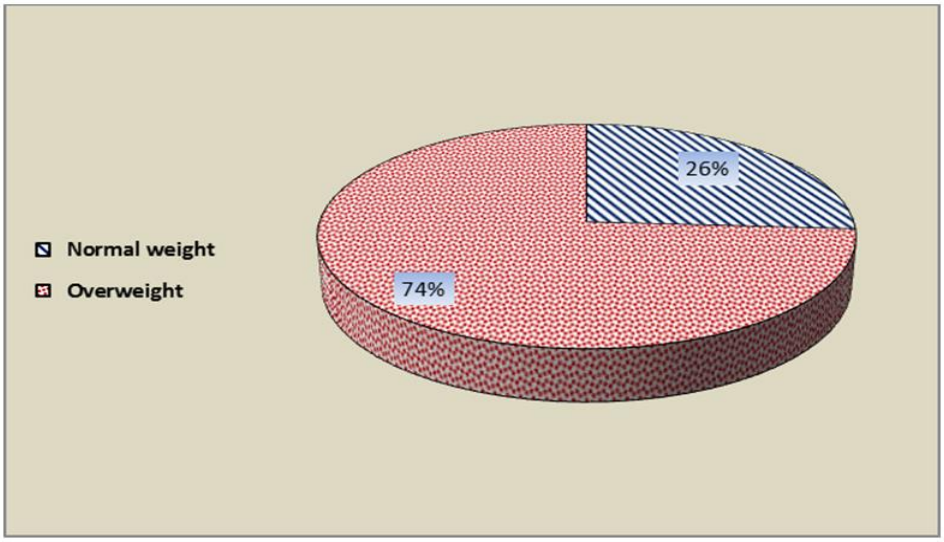

Fig. (1) Percentage distribution of the studied pregnant women according to their BMI pre pregnancy. (n = 100)

Table (2) Percentage distribution of the studied pregnant women according to their past and present history of CTS (n = 100)

History	%
Previous history of CTS	
- Yes	20.0
- No	80.0
Previous postural care and precautions are practiced (N=20)	60.0
Previous use of resting hand support (N=20)	70.0
Previous family history	44.0
Present history	
Wrist pain	100.0
Location	22.0
- Right hand	40.0
- Left hand	50.0
- Right and left	10.0
Nature of pain	
- Radiating	70.0
- Sharp	22.0
- Dull	8.0
Swelling in wrist and hand	92.0
Alteration in sensation	36.0

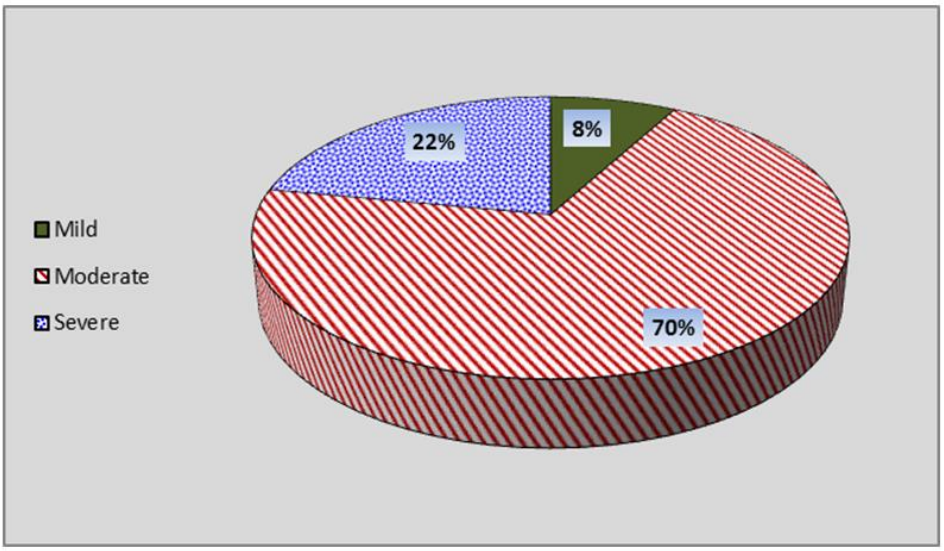

Fig. (2) Percentage distribution of the studied pregnant women according to their CTS pain severity (n = 100)

Table (3): Percentage distribution of the studied pregnant women according to their knowledge regarding CTS pre and post intervention (n=100).

Items	Pre intervention			Post intervention			FET	P value
	Correct answer %	Incomplete answer %	Don't know %	Correct answer %	Incomplete answer %	Don't know %		
- **Meaning of CTS**	10.0	42.0	48.0	56.0	44.0	0.0	37.190	0.000*
- **Causes of CTS**	0.0	24.0	76.0	64.0	36.0	0.0	13.889	0.000*
- **Risk factors of CTS**	0.0	19.0	81.0	72.0	28.0	0.0	9.122	0.003*
- **Symptoms of CTS**	2.0	50.0	48.0	79.0	21.0	0.0	23.769	0.000*
- **Diagnosis CTS**	0.0	16.0	84.0	60.0	40.0	0.0	12.698	0.000*
- **Complication of CTS**	0.0	32.0	68.0	81.0	19.0	0.0	11.038	0.001*
- **Prevention of CTS**	0.0	39.0	61.0	88.0	12.0	0.0	8.718	0.003*
- **Self-care measures of CTS**	2.0	41.0	57.0	90.0	10.0	0.0	8.382	0.015*

FET = Fisher's Exact Test, *statistically significant difference at P ≤ 0.05

Table (4): Mean differences of CTS symptoms severity scores among the studied pregnant women pre and post intervention (n=100).

Symptoms severity questions	Pre-intervention Mean ± SD	Post-intervention Mean ± SD	Paired t test	P value
- **Hand or wrist Pain at night**	3.58±0.92	1.66±0.74	.881	0.000*
- **Hand or wrist Pain Waking up at night**	3.36±0.62	1.49±0.67	.629	0.000*
- **Hand or wrist Pain during the daytime**	3.14±0.53	1.34±0.47	.368	0.000*
- **Frequency hand or wrist pain during the daytime**	4.38±0.74	1.35±0.50	.558	0.000*
- **Hand or wrist Pain duration**	3.70±1.34	1.29±0.45	.580	0.000*
- **Numbness in hand**	3.74±0.98	1.60±0.56	.427	0.000*
- **Weakness in hand**	3.44±0.49	1.28±0.45	.524	0.000*
- **Tingling sensation in hand**	3.28±0.77	1.21±0.40	.510	0.000*
- **Numbness at night**	3.42±0.72	1.70±0.46	.320	0.001*
- **Numbness & tingling waking up at night**	4.18±0.55	1.88±0.65	.557	0.000*
- **Difficulty grasping**	3.85±0.90	1.74±0.59	.697	0.000*

*statistically significant difference at P ≤ 0.05

Table (5): Percentage distribution of the studied pregnant women according to their function status pre and post intervention (n=100)

Items	Pre intervention					Post intervention					FET	P Value
	No Difficulty %	Mild Difficulty %	Moderate Difficulty %	Sever Difficulty %	Cannot Do At All %	No Difficulty %	Mild Difficulty %	Moderate Difficulty %	Sever Difficulty %	Cannot Do At All %		
- **Writing**	0.0	8.0	34.0	50.0	8.0	64.0	36.0	0.0	0.0	0.0	25.086	0.000
- **Buttoning of clothes**	0.0	14.0	30.0	48.0	8.0	69.0	26.0	5.0	0.0	0.0	16.297	0.012
- **Holding a book**	0.0	14.0	36.0	36.0	14.0	62.0	38.0	0.0	0.0	0.0	22.724	0.000
- **Gripping of a telephone handle**	0.0	42.0	44.0	14.0	0.0	94.0	6.0	0.0	0.0	0.0	39.212	0.000
- **Opening of jars**	0.0	22.0	8.0	64.0	6.0	78.0	22.0	0.0	0.0	0.0	30.073	0.000
- **Household Chores**	0.0	36.0	42.0	8.0	14.0	72.0	22.0	6.0	0.0	0.0	96.750	0.000
- **Carrying of grocery bags**	0.0	20.0	44.0	8.0	28.0	72.0	28.0	0.0	0.0	0.0	77.101	0.000
- **Bathing and dressing**	16.0	52.0	26.0	6.0	0.0	94.0	6.0	0.0	0.0	0.0	18.016	0.003

FET = Fisher's Exact Test, * statistically significant difference at P ≤ .05

Table (6): Mean differences of CTS total knowledge, symptoms severity and function status scores among the studied pregnant women pre and post intervention (n=100).

Items	Maximum score	Pre intervention Mean ± SD	Post intervention Mean ± SD	Paired t test	P value
- **Total knowledge**	16	5.98 ± 2.77	10.51 ± 1.96	51.812	0.000*
- **Symptoms severity score**	55	39.80 ± 5.05	16.54 ± 2.75	63.43	0.000*
- **Function status scale**	40	25.50 ± 4.58	10.06 ± 1.73	45.76	0.000*

*A statistical significant difference (P ≤ 0.05)

Table (7): Correlation coefficient between studied pregnant women' symptoms severity scores and their function status pre and post intervention (n=100).

Variables		Symptoms severity scores	
		r	P
Function status	**Pre-intervention**	0.645	0.000*
	Post-intervention	0.392	0.000*

*A statistical significant difference (P ≤ 0.05)

IV. Discussion

Carpal tunnel syndrome is a common problem during pregnancy that causes a tingling sensation, numbness and sometimes pain in the hand and fingers. 60% of pregnant women may experience symptoms of CTS. Symptoms vary and can range from mild to very painful, and may affect one or both hands. Swelling in hands is caused by a build-up of fluid in the tissues. Some of this fluid can collect in the carpal tunnel, placing pressure on the median nerve, compressing it and causing tingling and numbness in hands and fingers, majority of women have symptoms that are severe enough to affect hand function and sleep indicating that quality of life is significantly affected in these patients. Recent studies suggest some steps can take to reduce symptoms and some exercises that may help [19].

The aim of the current study was to evaluate the effect of an educational intervention about CTS on the pregnant women' knowledge, symptoms severity, and function status. The study finding revealed acceptance of research hypothesis, which indicate that pregnant women' knowledge, symptoms severity, and function status will be improved after implementation of an educational intervention about CTS.

Regarding the socio demographic characteristics of the studied pregnant women, the present study showed that more than half of the studied women were aged 30 - 40 years with mean age of 30.68±6.88, about three- quarters of the studied women were working and overweight. These study findings are agreed with at least three other researchers. The first, Ganjoo et al., [24] who had conducted their study on 60 females with CTS to determine the major risk factors of CTS. Reported that the risk factors were attributed to pregnancy, lactation, and occupation. The second, Ali & Sathiyasekaran, [25] who had conducted their study to find out the prevalence of CTS among computer professionals in India, found the prevalence of CTS was higher in the age group above 30 compared to 20-30 years. The third, Newington et al., [26] they had reported that, CTS is a common clinical problem which frequently presents among working pregnant women. This evidence suggest that the age of the women and occupational factors play an important role in CTS, particularly work which involves exposure to repetitive movements and/or hand-held vibratory tools.

Moreover, the findings of the current study revealed that the mean gestational age among the studied pregnant women were 30.45± 2.66 weeks and the most of them had swelling in the wrist and hand. These results suggested that CTS commonly presents during the third trimester of pregnancy. These findings in the same line with Meems et al., [4] and Sapuan et al., [27] The former, had conducted a study to determine the prevalence, and determinants of CTS during pregnancy, stated that 40% of their studied subjects reported the onset of symptoms after 30 weeks and added that pregnancy with CTS found significantly higher fluid retention during gestation compare with pregnant without CTS symptoms. The Latter, had conducted a prospective cross-sectional study, on 333 pregnant women to describe CTS in relation to pregnancy. Documented that CTS is more prevalent in the third trimester of pregnancy. The interpretation of researchers was the fluid retention increased during gestation in all women, which is consistent with the normal physiological pattern during pregnancy. The amount of weight gained between 20 and 30 weeks of pregnancy is largely attributed to an increase in maternal fat stores. After 30 weeks, an increase in extravascular fluid leads to greater weight gain. This explains why CTS symptoms most commonly present after 30 weeks' gestation.

Additionally, the finding of the current study proved that there are general improvement after the intervention in all items related to pregnant women' knowledge which include meaning, causes, risk factors, symptoms, diagnosis, complication, prevention, and self-care measures of CTS as compared to before intervention. These findings reflect the lack of community awareness and lack of implementing educational program regarding pregnancy related complication as CTS, whereas, no previous study has clearly evaluated the effect of educational intervention regarding CTS on pregnant women knowledge or health behaviour.

On the other hands, these findings were supported by a literature review, which stated that patient education should include instruction in self-management techniques including sleeping postures which avoid excessive wrist flexion; ergonomics; and a home therapy program to provide symptomatic relief that includes heat treatment, stretching exercises and nerve gliding [28]. Also, Rozali et al., [29] recommended proper education; reassurance and conservative measures should be given to mothers with CTS during pregnancy.

Concerning the severity of CTS symptoms among the studied women, the findings of the current study revealed a significant reduction ($P< 0.05$) in CTS symptom after the intervention. There are no previous studies in this regards aimed to assess the effectiveness of an educational intervention on symptoms reduction and function status of pregnant women with CTS. So we discussed the results of the other researches close to this intervention which include the conservative therapy, because it is already within the current educational intervention.

These findings in the same line with five other researchers, the first Hashempur et al., [16] in their study entitled "CTS in lactation: a challenging issue". Reported that conservative management, including reassurance and nursing counselling, splinting and medical therapy are the first line of treatment CTS. The second De-la-Llave-Rincon et al., [30] they had conducted their study to examine the combined effects of soft tissue mobilization and nerve slider neurodynamic technique on pain and pressure sensitivity in women with

chronic CTS, Reported that the application of soft tissue mobilization and neurodynamic technique decreased the intensity of pain. The third Yazdanpanah et al., [31] stated that conservative management protocols be safe and effective for treatment of pregnant women with CTS. The fourth Abbas, [32] who had found more than half of the studied group had a good response to conservative treatment including (lifestyle modification, wrist splints, exercise) and the mild-to-moderate presentation picture in some cases keeps the conservative treatment options as a more appealing choice as a first line of treatment. The fifth, Kwolek, and Zwolińska, [33] study which aimed to evaluate the immediate and long-term effects of conservative treatment involving ultrasound therapy combined with massage therapy for CTS. The researcher confirmed the effectiveness of the therapeutic programme. They found a significant improvement concerning the majority of the symptoms, quality of sensation, the hand range of motion, and muscle strength.

Furthermore, the current study demonstrated that the function status of the studied pregnant women which include writing, buttoning of clothes, holding a book, gripping of a telephone handle, opening of jars, household chores, carrying of grocery bags, bathing and dressing were significantly improved ($P< 0.05$) after the intervention. These findings are in accordance with Dinarvand et al., [34] they had conducted a randomized control trial to evaluate the effect of hamate and scaphoid bone mobilization alongside splinting in women with CTS. They showed a significant improvement in pain and symptom severity, function status in mobilization group. Furthermore, in a randomized controlled trial was performed by Pratelli et al., [35] to evaluate the effectiveness of conservative treatment of CTS. The researchers demonstrated the ability of manual therapy to improve pain, signs, symptoms, and function of those with CTS. Also, Elliott and Burkett, [36] they conducted study to evaluate the efficacy of massage therapy as a treatment for CTS. Demonstrated a significant ($p < 0.001$) change in symptom severity and function status two weeks after the intervention. Moreover, Hall et al., [37] investigated the effects of wearing a wrist support splint and receiving a formal education program on patients with CTS, Revealed that participants wearing a wrist splint full-time for 8 weeks and receiving a structured education program conducted by health care provider had greater symptom relief and better functional outcomes than the control group. These findings point to the successful effect of the educational intervention about CTS on the expectant woman life by enabled pregnant women to identify possible risk factors in their daily activities, empowering them to modify their routines to minimize the impact of CTS during pregnancy.

V. Conclusion

Based on the findings of the present study, it can be concluded that, the above mentioned findings proved and reinforced the study hypothesis. The implementation of an educational intervention about CTS was effective in improving pregnant women's life, through enhancing their knowledge regarding CTS, declining their CTS symptoms severity, and improving their function status to perform activities of daily living.

VI. Recommendations

Based on findings of the current study, the following recommendations can be suggested:

- The nurses should provide all pregnant women at antenatal clinics with a self-care guideline about CTS to improve their awareness.
- The curricula of nursing education should revised and updated to involve CTS during pregnancy and related care.

Further research

- Controlled clinical trials are needed to establish the absolute and relative effectiveness of this intervention.

Acknowledgements

The authors would like to express their appreciation and gratitude to all pregnant women who willingly participated in the study and kind appreciation to Dr.Ahmed Mostafa Ali ;the physiotherapist who helped us in implementation of the study.

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Abd Elmoniem, S.O., Abd-Elhakm, A.M., Ibrahim, H.A. "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 (IOSR-JNHS), vol. 7, no. 06 , 2018, pp. 19-28.