ECRONICON OPEN ACCESS

EC NEUROLOGY
Review Article

Carpal Tunnel Syndrome among the Visitors of Primary Healthcare Centers in Riyadh, Saudi Arabia

Parameaswari P Jaganathan[1]*, Abdulaziz Ahmed AlJasser[2], Sarah Abdullah AlKahtani[3], Naif Abdurhman Alrudian[4], Yazeed Musaad Alkhuzim[5], Rawan Khalid Aloteebi[6], Mohamed Salih Abdalla Elamin[7], Lujain Khalid Almajed[8], Saad Mohammed Alalyani[8], Sultan Mohammed Alotaibi[8] and Ahmed Hasan Althobaiti[9]

[1]*Research and Innovation Center, King Saud Medical City, MOH, Riyadh, Saudi Arabia*

[2]*King Fahad Medical City, MOH, Riyadh, Saudi Arabia*

[3]*Medical Intern, Al Mareefa University, Riyadh, Saudi Arabia*

[4]*Family Medicine and Public Health Lecturer, Prince Sattam Bin Abdulaziz University College of Medicine: Al-Kharj, King Saud Medical City, Riyadh, Saudi Arabia*

[5]*General Practitioner Resident at Ministry of Health, Riyadh, Saudi Arabia*

[6]*Medical Intern, Al Mareefa University, Riyadh, Saudi Arabia*

[7]*Surgery Resident, Care National Hospital, Riyadh, Saudi Arabia*

[8]*Medical Student, Al Mareefa University, Riyadh, Saudi Arabia, Riyadh, Saudi Arabia*

[9]*Neurology Consultant, Medicine/Neurology, King Saud Medical City, Riyadh, Saudi Arabia*

***Corresponding Author:** Parameaswari P Jaganathan, Consultant-Research and Innovation Center, Data Manager- Saudi Trauma Registry, King Saud Medical City, MOH, Riyadh, Saudi Arabia.

Received: November 06, 2020; **Published:** November 30, 2020

Abstract

Everyone has to be techy savvy, frequent use of computers, handheld gadgets in routine life are inevitable and one of the Public health concerns. Carpal tunnel syndrome is the most common peripheral nerve disorder, the main entrapment of the median nerve at the wrist. Our study aimed to estimate the prevalence of Carpal Tunnel Syndrome (CTS) and its associated factors among the visitors of Primary health care canters in Riyadh city. A Cross-Sectional Study was conducted by personal interview method using a structured questionnaire from June 2018 until Dec 2019 among 1292 visitors. Participants were selected at random with their consent and included in the study. The data was analyzed using SPSS 25.0, Parametric- t-test, ANOVA, Correlation - Chi-Square, Mann Whitney tests and Multivariate Logistic Regression analysis was performed at a 5% level. The present study revealed that the prevalence of CTS in the community was 11.6%, and males had more than a two-fold risk of developing CTS symptoms than females. The correlation between Functional Status Score and BMI was moderately positive with r = +0.678 (P = 0.009). The multivariate logistic regression predicted the risk factors of CTS as frequent use of the right hand with OR = 4.4 (1.8 - 9.2), using computers in office more than 6 hours per day increased the risk to OR = 4.8 (1.9 - 12.5) times. Among those detected with CTS, 72% had pain episodes between 10 to 60 minutes during daytime, 68% had moderate to severe numbness in their hand, and 54.7% had severe numbness or tingling at night. Our study exposed Obesity, long hours of work in computer/laptop, and use of mobile were robust risk factors influencing CTS in the general population. More programs should be designed to elicit various occupational factors leading to CTS.

Keywords: *Carpal Tunnel Syndrome; Cross-Sectional Study; Personal Interview Method; Symptom Severity Score*

Introduction

The most common peripheral nerve disorder is entrapment of the median nerve at the wrist which is called carpal tunnel syndrome (CTS) [1]. It is a result of a compression of the median nerve within the carpal tunnel [2]. Typically, patients have paraesthesia, numbness, tingling, and pain involving fingers supplied by the median nerve which have a tendency to worsen at night [3]. Pain can go up beyond median nerve supply and travel up the forearms, muscular weakness eventually happens if the compression is not relieved. Usually, the dominant hand is more affected but both hands may be involved, and pain improves by shaking of the hand [4].

CTS is associated with certain risk factors such as diabetes, hypothyroidism, hemodialysis, pregnancy, rheumatoid arthritis, and occupational factors [5,6]. Various studies have reported that CTS is associated with different work-related factors, mainly repetitive movements, forceful manual exertion, frequent twisting of the wrist, and hand-arm vibration [7-9]. Healthcare workers are at risk for developing upper extremity musculoskeletal disorders, including CTS [10]. Most of the studies that investigated the prevalence and risk factors of CTS among laboratory technicians used a clinical diagnosis of CTS only [10-12].

Although CTS was reported as the commonest form of peripheral neuropathy [1], only a few studies reported its prevalence among the general population. A Swedish population-based study reported an overall prevalence of 14.4% with a 1:1.4 male to female ratio [13]. An older population-based study in the Netherlands reported an overall prevalence of CTS at 7.4% with a higher female to male ratio [14].

Due to the shortage of local studies on the prevalence of CTS in the general population, we intend to compare the local and international data. Our study aimed to estimate the prevalence of CTS among visitors of Primary health and Tertiary care centers and to investigate the factors associated with CTS among those unexposed to the confounding factors. More specifically we wished to find if the electronic gadgets of daily routine use were associated with the prevalence of CTS.

Materials and Methods

A Cross-Sectional study was conducted from June 2018 until December 2019 among randomly selected 1292 visitors from 16 Primary Health Care centers (PHC) - Al Hayer, AlShifa, Bader 1st, Al Oraija middle, Twaiq, Aldar Albaida, Almarwa, AlSwaidi, Sultana, Labn west, AlRawdah, Arabi, Al Yasamin, An Nafal, Al Wasi, Al Masif, and those referred from PHC to Family Medicine outpatient clinic of King Saud Medical City (KSMC) and Prince Sultan Military Medical City (PSMMC) covering all areas (North, East, South and West) of Riyadh city. The verbal informed consent was obtained from the participants who fulfilled the inclusion and exclusion criteria. The minimum required sample size was estimated as 1070 based on a prevalence of 9.7% and 20% precision [15]. The inclusion criteria were adult (≥ 14 years) visitors from the study area. The exclusion criteria included participants with a history of hand trauma, diabetes, hypothyroidism, rheumatoid arthritis, undergone surgery for CTS, and work experience of fewer than 12 months.

Nine medical research investigators had prior training to collect the data by the Personal Interview method and took nearly 30 - 45 minutes to survey each participant with the following Tools.

Tool

A Structured questionnaire with 5 sections -17 Demographic variables in the first section, 14 variables related to exercise, use of handheld devices, use of computers with its time and mode of commute in the second section, 9 variables on the history of injury, fracture, CTS, Surgery, morbidity and Pregnancy status of women in the third section. The fourth section consisted of 'Functional Status Scale (FSS)' [16] to measure CTS among the Participants and those recognized with a total score of 'equal to and above 10' were assessed by the 'Symptom Severity Scale (SSS)' [16] for CTS in the fifth section. The two scales were used to find if the participants had hand and wrist symptoms that caused difficulty in doing the activities listed in the scales during the past two weeks from the date of the survey. These participants with CTS were referred to the Neurology and Orthopaedic department of our hospital for further diagnostic evaluation and treatment.

Functional status scale (FSS)

It consists of 8 items related to a variety of activities commonly performed by a broad spectrum of patients (young and elderly and includes indoor and/or outdoor activities). Each item is rated on a 1 to 5 -point Likert scale with higher ratings indicating more pain and disability. Hence this tool assessed qualitatively and was used as a Screening tool for CTS.

Symptom severity scale (SSS)

This scale consists of 11 items related to six domains said to be critical for the evaluation of CTS.

Ethical considerations

This study was approved by the Institutional Review Board [H1RI-16-Apr18-03]. Verbal informed consent was obtained from all the participants. Confidentiality, anonymity, and storage of the collected data were preserved in compliance with the National Bioethics Guidelines.

Statistical analysis

There were 1303 participants in our study with a response rate of 98% and calculated the Prevalence of CTS. Subgroup analysis for 1292 was done to find the associated risk factors with CTS by excluding 11 participants exposed to confounding factors like obesity, pregnancy, diabetes, hypothyroidism, rheumatoid arthritis and/or any endocrine disorders. The data was analyzed using SPSS 25.0 (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). The results were presented in frequency, the percentage for non-normal data and mean, standard deviation, range, median, Interquartile range for the continuous variables chi-square test, odds ratio, and 95% confidence interval. Mann Whitney test for binary variables, Kruskal Wallis test for more than two categorical variables and t-test, Binary Logistic Regression model was formulated to determine the factors predicting CTS and were all tested with 5% level of statistical significance.

Results

The Study comprised of 1175 (90.9%) Saudi Nationals and 117 (9.1%) Saudi Expats with 614 (47.5%) females and 678 (52.5%) males with a Median (IQR) age 33 (26 - 42) years. Table 1 shows the baseline characteristics of the participants along with the P-value between CTS and non-CTS categories. We observed a majority of 425 (32.9%) undergraduates followed by 335 (25.9%) till school level, 156 (12.1%) diploma holders, respectively. At the time of the survey, 802 (62.1%) had a full-time job for at least 8 hours per day and 470 (36.4%) also were part-time workers, 59% of the total, earned more than SAR 5,000/- per month comprising 399 (30.9%) professionals, 123 (9.5%) managers, 81 (6.3%) Service and Sales workers, 77 (6.0%) technicians and associate professionals, 420 (32.5%) elementary occupations, 6 (0.5%) from skilled agricultural, forestry and fishery is displayed in figure 1.

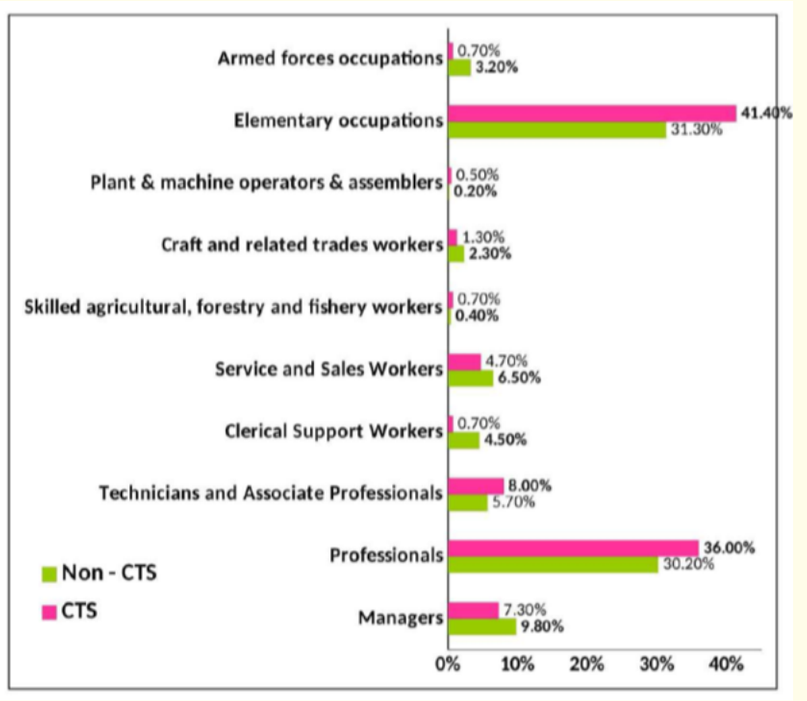

Figure 1: *Participants according to unified Saudi occupation classification (n = 1292).*

Variables	Non - CTS [N = 1142 (88.4%)]	CTS [N = 150 (11.6%)]	P-value
Age in Years, Mean ± SE	35.23 ± 12.43	36.1 ± 10.91	0.417
Gender - Female	511 (44.7%)	103 (68.7%)	0.0001*
Male	631 (55.3%)	47 (31.3%)	0.0015*
Nationality - Saudi Expat	102 (8.9%)	15 (10.0%)	0.8901
Saudi National	1040 (91.1%)	135 (95.0%)	0.1255
Education - Illiterate	42 (3.7%)	8 (5.3%)	0.8332
Primary	71 (6.2%)	15 (10.0%)	0.5990
Secondary	100 (8.8%)	18 (12.0%)	0.6681
High School	310 (27.1%)	25 (16.7%)	0.2567
Diploma	137 (12.0%)	19 (12.7%)	0.9303
Undergraduate	379 (33.2%)	46 (30.7%)	0.7336
Post graduate	103 (9.0%)	19 (12.7%)	0.6160
Current Job - Full Time	710 (62.2%)	92 (61.3%)	0.8671
Part Time	432 (37.8%)	58 (38.7%)	0.8946
Current Job in Hours / day - Full Time	7.82 ± 0.04	7.96 ± 0.13	0.0001*
Part Time	0.45 ± 0.19	0.52 ± 0.08	0.0001*
Income per Month (SAR) - <225/-	31 (2.7%)	1 (0.7%)	0.9038
225/- to 1000/-	54 (4.7%)	8 (5.3%)	0.9413
1000/- to 5000/-	226 (19.8%)	33 (22.0%)	0.7687
5000/- to 10000/-	319 (27.9%)	32 (21.3%)	0.4250
>10,000/-	356 (31.2%)	45 (30.0%)	0.8700
Marital Status - Single	389 (34.1%)	33 (22.0%)	0.1757
Married	688 (60.2%)	96 (64.0%)	0.4755
Widow/Divorced/Separated	65 (5.7%)	21 (14.0%)	0.2183
Family Members - < 5	566 (50.3%)	74 (50.0%)	0.9613
6 - 10	463 (41.1%)	63 (42.6%)	0.8207
≥ 11	97 (8.6%)	11 (7.4%)	0.8928
Family Type - Nuclear	921 (80.6%)	114 (76.0%)	0.2462
Extended	221 (19.4%)	36 (24.0%)	0.5234

Smoker - Yes	213 (18.7%)	20 (18.3%)	0.9651
Alcoholic - Yes	14 (1.2%)	2 (1.3%)	0.9907
Physical Activity - Inactive	492 (43.1%)	66 (44.0%)	0.8899
Minimally Active	286 (25.0%)	40 (26.7%)	0.8169
Active	327 (28.6%)	39 (26.0%)	0.7337
Hyperactive	37 (3.2%)	5 (3.3%)	0.9906
BMI - < 18.5	41 (3.6%)	3 (2.0%)	0.8886
18.5 - 24.9	377 (33.0%)	54 (36.0%)	0.6623
25 - 29.9	421 (36.9%)	41 (27.3%)	0.2222
30 - 39.9	254 (22.2%)	39 (26.0%)	0.5985
≥ 40	49 (4.3%)	13 (8.7%)	0.5295

Table 1: *Baseline characteristics of the participants.*
**Statistically significant at 5% level.*

Seven hundred and seventy-five (60%) were married, 389 (34.1%) singles and we noticed 1035 (80.1%) of the participants from the nuclear family, 233 (18%) smokers and 16 (1.2) alcoholic. We considered the participants to be inactive if they did not exercise vigorously for more than 80mts per week, hence we observed 558 (43.2) to be Inactive, 326 (25.2) minimally active with 56% being Overweight and Obese and leading a Sedentary life.

One thousand one hundred and sixty-four (90.1%) respondents frequently used right hand for their daily routine work, 85 (6.6%) left-handed, and 43 (3.3%) ambidextrous. Ninety-three participants (7.2%) were using vibrating tools ranging between 5 to 12 hours per day. Exercises like dance, aerobics, walking, jogging, Zumba performed by 111 (8.6%), 292 (22.6%) had workouts like cardio, gym, running, cycling, swimming, jumping, treadmill, yoga, and the exercises - weightlifting, Barbells, push up, dumbles, CrossFit resistance, construction materials were done by 49 (3.8%).

Table 2 presents the factors associated with CTS compare to non-CTS patients. Four hundred and sixty- two (35.8%) were continuously using Computer-PC/Laptop in Office ranging between 3 to 12 hours per day, among them 390 (30.2%) used the mouse with a median of 6 hours and 134 (10.4%) the hand support on an average of 3 hours. Three hundred and fifty-three (27.3%) used PC/Laptop in the home from 1 to 6 hours per day, 91 (7.0%) used the mouse with a median 2 hours, and 66 (5.1%) the hand support for 2:30 hours.

Factors	No CTS [N = 1142 (88.4%)]	CTS [N = 150 (11.6%)]	P-value
Frequently used Hand - Left	69 (6.0%)	16 (10.7%)	0.5060
Right	1035 (90.6%)	129 (86.0%)	0.0993
Ambidextrous	38 (3.3%)	5 (3.3%)	1.000
Use Vibrating Tools/day - Yes	77 (6.7%)	16 (10.7%)	0.5799
No	1065 (93.3%)	134 (10.4%)	0.0001*
Use Vibrating Tools (Hours/day) - Yes	1:59 ± 0:23	2:30 ± 1:19	0.4756
Weight Lifting Exercise/week - Yes	103 (9.0%)	8 (5.3%)	0.7222
No	1039 (91.0%)	142 (94.7%)	0.1394
Weight Lifting Exercise (Hours/week) - Yes	1:59 ± 0:12	0:87 ± 0:12	0.1023
Type of Exercise - Light Weight	261 (89.4%)	31 (20.7%)	0.0001*
Heavy Weight	45 (3.9%)	4 (2.7%)	0.9053

Use of Computer-PC/Laptop in Office/Day			
Yes	406 (35.6%)	56 (37.3%)	0.8038
No	736 (64.4%)	94 (62.7%)	0.7463
Use of Computer-PC/Laptop in Office (Hours/Day) - PC	4.58 ± 0.14	4.62 ± 0.40	0.0151*
- Laptop	3.96 ± 0.25	3.91 ±0.80	0.1095
Use of Mouse for Computer-PC/Laptop in Office/Day - Yes	346 (30.3%)	44 (29.3%)	0.8919
No	796 (69.7%)	106 (70.7%)	0.8332
Use of Mouse for Computer-PC/Laptop in Office (Hours/Day) - Yes	4.31 ± 0.14	4.50 ± 0.43	0.0001*
Use of Hand-support for Computer - PC /Laptop in Office/Day - Yes	116 (10.2%)	18 (12.0%)	0.8169
No	1026 (89.8%)	132 (88.0%)	0.5239
Use of Hand-support for Computer-PC /Laptop in Office (Hours/Day) - Yes	3.25 ± 0.27	4.56 ± 0.73	0.0001*
Use of Computer-PC/Laptop in Home/Day - Yes	308 (27.0%)	45 (30.0%)	0.6738
No	834 (73.0%)	105 (70.0%)	0.5159
Use of Computer-PC/Laptop in Home (Hours/Day) - PC	2.54 ± 0.31	2.00 ± 0.57	0.0001*
Laptop	2.86 ± 0.17	3.35 ± 0.35	0.0001*
Use of Mouse for Computer-PC/Laptop in Home/Day - Yes	81 (7.1%)	10 (6.7%)	0.9630
No	1061 (92.9%)	140 (93.3%)	0.8621
Use of Mouse for Computer-PC/Laptop in Home (Hours/Day) - Yes	2.1 ± 0.19	2.7 ± 0.73	0.0001*
Use of Hand-support for Computer-PC/Laptop in Home/Day- Yes	57 (5.0%)	9 (6.0%)	0.9003
No	1085 (95.0%)	141 (94.0%)	0.6123
Use of Hand-support for Computer-PC/Laptop in Home (Hours/Day) - Yes	0.87 ± 0.16	0.11 ± 0.11	0.0001*
Use of Mobile /Day - Yes	1091 (95.5%)	144 (96.0%)	0.7844
No	51 (4.5%)	6 (4.0%)	0.9556
Use of Mobile (Hours/Day) - Yes	6.28 ± 0.13	6.58 ± 0.38	0.0001*
Drive - Car	629 (55.1%)	48 (32.0%)	0.002*
Motor Cycle	20 (1.8%)	0	-

Table 2: *Factors associated with carpal tunnel syndrome.*

**: Statistically significant at 5% level.*

One thousand two hundred and fifty-nine (97.4%) used android mobiles with a median (IQR) of 9 (3 to 12) hours daily, the mobile brands were grouped based on the model and the weight. The majority of our participants 829 (64.2%) used iPhone, 264 (20.4%) Samsung/Sony, 119 (9.2%) Huawei/Panasonic, 30 (2.3%) used HTC/Lenovo/LG/Nokia/Philips and 17 (1.3%) used Alcatel/Honor/Nova/One plus/Xiomi is shown in figure 2.

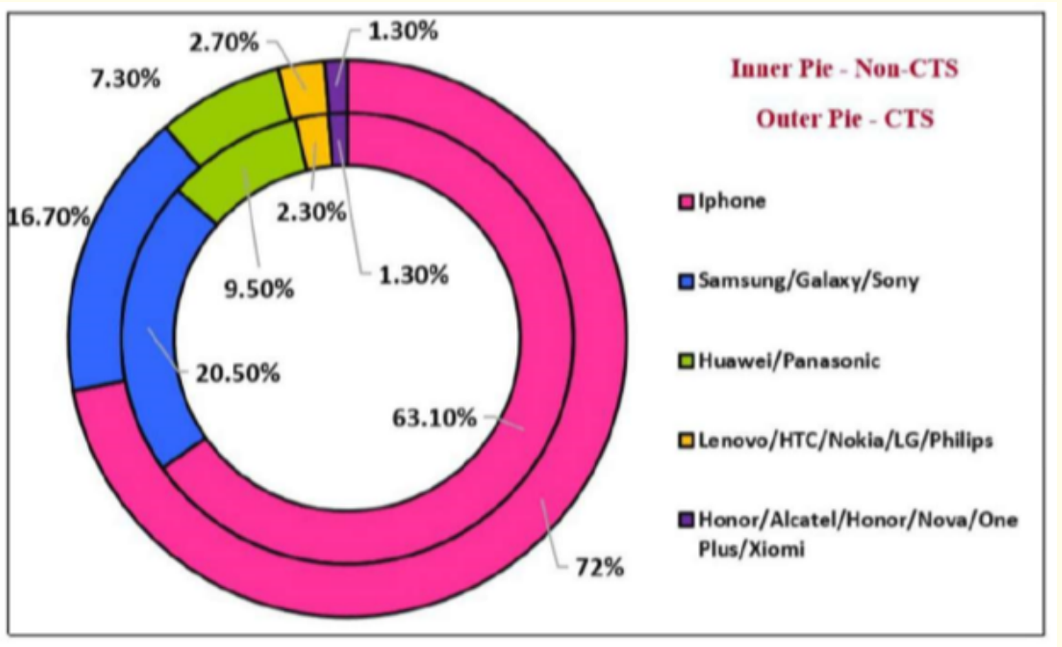

Figure 2: *Mobile brands used by the participants (n = 1292).*

Six hundred and seventy-seven (52.4%) drove the car daily for nearly 3 to 6 hours and 20 (1.5%) rode the motorcycle for 1 to 4 hours per day. None of them were diagnosed for CTS before this study. The close relatives of 51 (3.9) respondents had CTS: for 11 (0.85%) of their sisters, 3 (0.23%) brothers, 14 (1.1%) mentioned as parents, 1 (0.07%) son, 1 (0.07%) wife.

The study identified 150 CTS cases with a 'Functional Status Scale Score more than 10', summarizing to 11.6% prevalence in the community among the Saudi population with a median age of 46.5 and IQR (38 to 53) years, where 50% of them worked for 7 hours per day. The mean Functional status score and the Symptom Severity Scale of CTS cases are depicted in figure 3, the correlation between these scores and BMI is displayed in figure 4 and 95% of them were willing to visit the hospital for further treatment. Seventy-five (50%) of our participants had difficulty in writing, 28% in buttoning of clothes, 43% in holding a book while reading, 55.3% in gripping of a telephone handle, 46% in performing the household chores, and 25% in bathing and dressing. The univariate and multivariate binary logistic regression analysis on the binary outcome variable 'presence of Carpal Tunnel syndrome' among 150 visitors from our study setting is provided in table 3 with the odds ratio and 95% confidence interval. In the second phase of our study, we have followed 62% of symptomatic patients till date and ruled out for Tendonitis. All of them were confirmed by the nerve conduction velocity test for CTS.

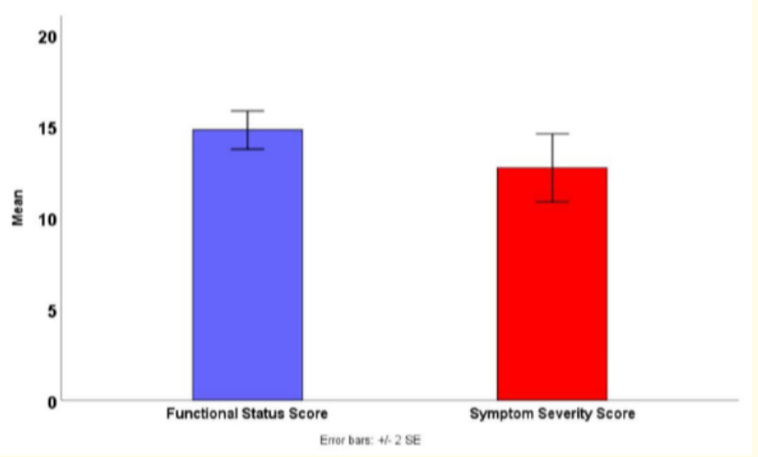

Figure 3: *Average functional status score and symptom severity score of participants with carpal tunnel syndrome (n = 150).*

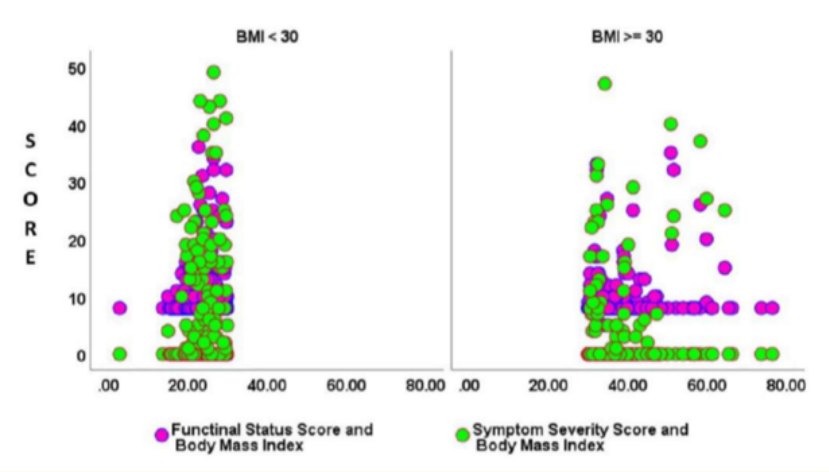

Figure 4: *Scatter plot for the BMI with functional status score and symptom severity score of CTS (n = 1292).*

Risk Factors	Univariate Analysis		Multivariate Analysis	
	Odds Ratio (95% CI)	P-value	Adjusted Odds Ratio (95% CI)	P-value
Gender - Male	1.71 (1.2 - 1.9)	0.000*	2.4 (1.3 - 6.7)	0.0001*
Work > 12 hours per day	1.8 (1.1 - 2.5)	0.037*	1.9 (1.3 - 3.6)	0.030*
BMI > 30.0	1.6 (1.5 - 2.1)	0.000*	3.7 (1.5 - 9.0)	0.006*
Marital status - Married	1.3 (1.9 - 2.6)	0.003*	2.4 (1.4 - 3.2)	0.000*
Frequently used Hand - Right	2.0 (1.1 - 3.9)	0.060*	4.4 (1.8 - 9.2)	0.050*
Use of Vibrating Tools	1.3 (0.7 - 2.2)	0.055	1.5 (0.7 - 3.0)	0.780
Use of Computer-PC/Laptop in Office 6 hours- Yes	2.3 (2.1 - 2.6)	0.001*	4.8 (1.9 - 12.5)	0.0001*
Use of Mouse in Office > 6 hours- Yes	0.8 (0.5 - 1.2)	0.076	0.9 (0.5 - 1.7)	0.348
Use of Computer-PC/Laptop in Home > 3hours - Yes	1.1 (0.8 - 2.7)	0.058	1.9 (1.4 - 4.6)	0.001*
Mobile use >8 hours per day- Yes	1.9 (0.5 - 2.9)	0.347	3.3 (1.5 - 5.8)	0.000*
Drive Car > 40 mts per day - Yes	1.4 (0.9 - 2.3)	0.062	1.8 (0.9 - 4.6)	0.072

Table 3: *Univariate and multivariate logistic regression analysis of carpal tunnel syndrome with their risk factors. Statistically Significant at 5% level.*

Discussion

The Iranian study observed the prevalence of clinical CTS symptoms as 16.7% [17]. Studies from Malaysia and Pakistan revealed a 21.2% and 10.3% prevalence of CTS respectively [18,19]. Another study conducted in Lahore, showed a 15.5% prevalence [20]. CTS symptoms are more prevalent in dentists than in the worldwide general population [20-24] and the present study measured a Prevalence of 11.6% in the community, with higher numbers observed among the middle-aged. CTS-related symptoms among dentists working in Riyadh was 30.5% (95% CI 0.25 to 0.36) [25].

According to Dale., *et al*. CTS in the United States had an incidence of 5.8% and a prevalence of 7 to 19%, with higher numbers seen in industrial workers, and the elderly [26,27]. Our participants (86%) from the general population prominently suffered from CTS in the frequently used right hand. Haghigath and Maeda's study found CTS occurs more commonly in the dominant hand, but it can occur in both hands [26,27]. As in AL Husain's study, symptoms consistent in the dominant hand was higher among occupational than in the general population [28] and is also consistent with similar studies of medical laboratory staff [29] and hairdressers,[30] although the reason (s) for this difference remains unknown.

Female dentists had a significantly greater risk of having CTS symptoms than male dentists (OR 2.13; 95% CI 1.09 - 4.17) [25]. We observed that the male gender had 2.4 times the risk of developing CTS compared to females and those in elementary occupations and professionals had 1.9 times risk when worked for more than 12 hours per day. We have excluded pregnant women and who were with hormonal changes for the analysis, female-specific factors such as hormonal changes and pregnancy can also cause CTS in women [31,32]. We observed the married respondents had 2.4 times the risk of developing CTS compared to singles and was not similar to the Khaled Khaleel study as it was more prominent among singles.

The current study found that a BMI of 30 or greater, an adult was more likely to complain of CTS symptoms i.e. 3.7 times significant risk between obesity and CTS. The obese Dentists had CTS compared to those of normal weight. Indeed, obesity is a strong risk factor for CTS in the general population [33] and numerous studies have obtained results consistent with this finding [25,28,34].

We observed that the male gender had 2.4 times the risk of developing CTS compared to females, with 1.9 times risk if worked for more than 12 hours per day, 3.7 times risk if they were overweight and obese. The frequent use of right hand had 4.4 times risk, by using computers in office more than 6 hours per day increased the risk to 4.8 times of having CTS and if the mobile use was more than eight hours per day had 3.3 times risk of developing CTS and use of these handheld electronic devices and being techy savvy in their daily routine work was all identified as the risk factors and is mentioned in table 3.

Maeda Y, Kettner study proved primary somatosensory cortex neuroplasticity for median nerve innervated digits in carpal tunnel syndrome is indeed maladaptive and underlies the functional deficits seen in these patients [35]. Among the 150 participants with CTS from this study, eighty-eight (58%) had a severe hand or wrist pain at night, for 45% the wrist pain woke them up during a typical night, 62% had pain in hand or wrist during the daytime, 61% had pain more than three times a day, 72% had pain episode between 10 to 60 minutes during daytime, 68% had moderate to severe numbness in their hand, 63% had weakness in the hand, 56% had tingling sensations, 54.7% had severe numbness or tingling at night, 47.3% had numbness or tingling and awakened them at least once at night, 43% had difficulty with the grasping and use of small objects such as keys or pens. In the Natraj and Evens study, Classic CTS symptoms and sensorimotor alterations include nocturnal pain associated with tingling, numbness, and - in more severe cases - weakness in the median nerve territory that affects the hand motor control, especially during activities involving the first three fingers [36,37]. A Cross-Sectional Study in Riyadh showed that the prevalence of hand pain among dentists working in Saudi Arabia was 14% [38].

Studies from the USA have revealed inconsistent results, with one study of Michigan showed a very high prevalence of CTS (32%), [34] while another in the same state revealed that only 3% of participating dental professionals had CTS [39].

Conclusion

The current study showed a very low prevalence but there existed a significant association between obesity, long hours of work in computers, mobile use per day, and CTS in the general population who visited our Health care centers. Those with CTS were referred for further diagnostic procedures and treatment. More awareness programs should be designed for the population to identify the risk factors influencing these symptoms and make appropriate interventional measures for a better outcome.

Acknowledgements

We the investigators acknowledge the staffs who coordinated in the study setting and the KSMC research centre services for their cordial support.

Conflict of Interest

There is no financial support and no conflicts of interest among the authors.

Bibliography

1. Anonymous. "Diagnosis of carpal tunnel syndrome (editorial)". *Lancet* 1 (1985): 854-858.
2. Katz JN., *et al*. "The carpal tunnel syndrome: diagnostic utility of the history and physical examination findings". *Annals of Internal Medicine* 112 (1990): 321-327.
3. Simon H. "Carpal tunnel syndrome - Diagnosis. University of Maryland Medical Center Review (2007).
4. Aroori S and Spence RA. "Carpal tunnel syndrome". *The Ulster Medical Journal* 77 (2008): 6-17.
5. Salati SA., *et al*. "Carpal Tunnel Syndrome in the patient on long term hemodialysis - A Case Report". *East and Central African Journal of Surgery* 15 (2010): 140-143.
6. Toosi KK., *et al*. "Computer keyboarding biomechanics and acute changes in median nerve indicative of carpal tunnel syndrome". *Clinical Biomechanics* 30 (2015): 546-550.
7. Abumunaser L. "Surgical treatment of carpal tunnel syndrome: our experience at King Abdulaziz University Hospital". *Pan Arab Journal of Orthopaedic Trauma* 13 (2009): 139-142.
8. Franklin GM and Friedman AS. "Work-related carpal tunnel syndrome: diagnosis and treatment guideline". *Physical Medicine and Rehabilitation Clinics of North America* 26 (2015): 523-537.
9. You D., *et al*. "Meta-analysis: association between wrist posture and carpal tunnel syndrome among workers". *Safety and Health at Work* 5 (2014): 27-31.
10. Ahamed SS., *et al*. "Prevalence and associated factors of Carpal Tunnel Syndrome (CTS) among medical laboratory staff at King Saud University Hospitals, KSA". *Pakistan Journal of Medical Sciences* 31 (2015): 331-335.
11. Occhionero V., *et al*. "Upper limb musculoskeletal disorders in healthcare personnel". *Ergonomics* 57 (2014): 1166-1191.
12. Agrawal PR., *et al*. "Work-related musculoskeletal disorders among medical laboratory professionals: a narrative review". *International Journal of Research in Medical Sciences* 2 (2014): 1262-1266.
13. Atroshi I., *et al*. "Prevalence of carpal tunnel syndrome in a general population". *The Journal of the American Medical Association* 282 (1999): 153-158.
14. De Krom MC., *et al*. "Carpal tunnel syndrome: prevalence in the general population". *Journal of Clinical Epidemiology* 45 (1992): 373-376.
15. El-Healy M., *et al*. "Carpal tunnel syndrome among laboratory technicians in relation to personal and ergonomic factors at work". *Journal of Occupational Health* 59 (2017): 513-520.

16. Levine. "A self-administered questionnaire for the assessment of the severity of symptoms and functional status in carpal tunnel syndrome". *Journal of Bone and Joint Surgery American* 75.11 (1993): 1585-1592.

17. Dale AM., *et al*. "Prevalence and incidence of carpal tunnel syndrome in US working populations: a pooled analysis of six prospective studies". *Scandinavian Journal of Work, Environment and Health* 39.5 (2013): 495-505.

18. Nataraj R., *et al*. "Effects of carpal tunnel syndrome on reach-to-pinch performance". *PLoS One* 9 (2014): e92063.

19. Werner RA., *et al*. "Prevalence of carpal tunnel syndrome and upper extremity tendinitis among dental hygienists". *Journal of Dental Hygiene* 76.2 (2002): 126-132.

20. Ehsan M., *et al*. "Frequency of carpal tunnel syndrome in dentists working in government hospitals of Lahore". *International Journal of Scientific Research* 14 (2013): 2319-7064.

21. Haghighat A., *et al*. "Prevalence of clinical findings of carpal tunnel syndrome in Isfahanian dentists". *Advanced Biomedical Research* 1 (2012): 13.

22. Lalumandier JA and McPhee SD. "Prevalence and risk factors of hand problems and carpal tunnel syndrome among dental hygienists". *The Journal of Dental Hygiene* 75.2 (2001): 130-134.

23. Anton D., *et al*. "Prevalence of musculoskeletal symptoms and carpal tunnel syndrome among dental hygienists". *American Journal of Industrial Medicine* 42.3 (2002): 248-257.

24. Munirah MA., *et al*. "Prevalence of Probable Carpal Tunnel Syndrome and its Associated Factors among Dentists in Kelantan". *International Journal of Collaborative Research on Internal Medicine and Public Health* (2014): 6.

25. Alhusain FA., *et al*. "Prevalence of carpal tunnel syndrome symptoms among dentists working in Riyadh". *Annals of Saudi Medicine* 39.2 (2019): 104-111.

26. Dale AM., *et al*. "Prevalence and incidence of carpal tunnel syndrome in US working populations: a pooled analysis of six prospective studies". *Scandinavian Journal of Work, Environment and Health* 39.5 (2013): 495-505.

27. Newington L., *et al*. "Carpal tunnel syndrome and work". *Best Practice and Research: Clinical Rheumatology* 29.3 (2015): 440-453.

28. Lam N and Thurston A. "Association of obesity, gender, age, and occupation with carpal tunnel syndrome". *Aust ANZ Journal of Surgery* 68.3 (1998): 190-193.

29. Ahamed SS., *et al*. "Prevalence and associated factors of Carpal Tunnel Syndrome (CTS) among medical laboratory staff at King Saud University Hospitals, KSA". *Pakistan Journal of Medical Sciences* 31.2 (2015): 331-335.

30. Demiryurek BE and Aksoy Gu ndo?du A. "Prevalence of carpal tunnel syndrome and its correlation with pain amongst female hairdressers". *International Journal of Occupational Medicine and Environmental Health* 31.3 (2018): 333-339.

31. Ablove RH and Ablove TS. "Prevalence of carpal tunnel syndrome in pregnant women". *World Mycotoxin Journal* 108.4 (2009): 194-196.

32. Padua L., *et al*. "Carpal tunnel syndrome in pregnancy: multiperspective follow-up of untreated cases". *Neurology* 59.10 (2002): 1643-1646.

33. Kim. "Carpal tunnel syndrome" 83.8 (2011): 952-958.

34. Hamann C., *et al*. "Prevalence of carpal tunnel syndrome and median mononeuropathy among dentists". *Journal of the American Dental Association* 132.2 (2001): 163-170.

35. Maeda Y., *et al*. "Functional deficits in carpal tunnel syndrome reflect the reorganization of primary somatosensory cortex". *Brain* 137 (2014): 1741-1752.

36. Nataraj R., *et al*. "Pathokinematics of precision pinch movement associated with carpal tunnel syndrome". *Journal of Orthopaedic Research* 32 (2014): 786-792.

37. Nataraj R., *et al*. "Effects of carpal tunnel syndrome on reach-to-pinch performance". *PLoS One* 9 (2014): e92063.

38. Al-Mohrej OA., *et al*. "Prevalence of musculoskeletal pain of the neck, upper extremities and lower back among dental practitioners working in Riyadh, Saudi Arabia: a cross-sectional study". *BMJ Open* 6.6 (2016): e011100.

39. Werner RA., *et al.* "Prevalence of carpal tunnel syndrome and upper extremity tendinitis among dental hygienists". *Journal of Dental Hygiene* 76.2 (2002): 126.

Volume 12 Issue 12 December 2020