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THE PREVALENCE OF CARPAL TUNNEL SYNDROME IN RETAIL STORE CASHIERS IN KARACHI, PAKISTAN

Original Research

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ABSTRACT

Background: Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy of the upper limb, caused by compression of the median nerve within the carpal tunnel. It is characterized by wrist pain, numbness, tingling, and in severe cases, muscle atrophy. The condition is frequently associated with repetitive hand motions, awkward wrist positioning, and prolonged flexion, making certain occupational groups particularly vulnerable. Among these, retail cashiers are at high risk due to the repetitive nature of their tasks and prolonged working hours.

Objective: To determine the prevalence of Carpal Tunnel Syndrome among retail store cashiers in Karachi, Pakistan.

Methods: A cross-sectional analytical study was conducted over six months among 191 retail cashiers from various areas of Karachi, using a convenience sampling technique. Participants included males and females aged 18–40 years with a minimum of one year of experience in cashier roles involving repetitive wrist movements. Data were collected using a structured questionnaire comprising the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) and the Visual Analogue Scale (VAS), assessing symptom severity and functional status. Data were analyzed using IBM SPSS version 26 with frequency distribution, chi-square tests, and correlation analysis.

Results: Out of 191 participants, 41 (21.5%) were diagnosed with CTS. Of the total sample, 176 (92.1%) were male and 15 (7.9%) were female. Participants aged 34–40 years formed the largest group (39.3%). A total of 69 (36.1%) had more than 7 years of work experience, and 145 (75.9%) reported working 40 or more hours per week. There was a statistically significant correlation between age and symptom severity ($p = 0.037$) and a moderate negative correlation between symptom severity and work-related factors ($r = -0.170$, $p = 0.018$).

Conclusion: The study identified a considerable prevalence of CTS among retail cashiers in Karachi. The findings emphasize the importance of ergonomic workplace interventions and preventive strategies to reduce CTS risk in high-exposure occupations. Further research is needed to explore occupation-specific risk contributors and evaluate long-term ergonomic solutions.

Keywords: Carpal Tunnel Syndrome, Cashiers, Ergonomics, Occupational Health, Prevalence, Retail Workers, Workplace Safety.

INTRODUCTION

Carpal tunnel syndrome (CTS) is widely recognized as the most prevalent nerve entrapment neuropathy, accounting for approximately 90% of all localized neuropathies reported globally (1). This condition significantly affects the personal and professional lives of millions worldwide, with an estimated global prevalence of 4–5% (2). The syndrome primarily targets adults aged between 40 and 60 years, and evidence suggests a notably higher incidence in women—up to three times more than in men—potentially influenced by anatomical or hormonal factors (3,4). In the United States alone, the annual incidence rate stands at 1–3 per 1,000 individuals, with a prevalence of 50 per 1,000 individuals (5). CTS is particularly burdensome among individuals whose occupations demand frequent and forceful hand and wrist motions, often combined with static postures. These include professions such as software developers, typists, cashiers, hairdressers, dentists, butchers, and others involved in repetitive manual tasks (6). CTS occurs due to the compression of the median nerve within the carpal tunnel—a narrow passageway formed by the carpal bones and the overlying flexor retinaculum. Various etiologies contribute to this compression, including repetitive stress injuries, rheumatoid arthritis (RA), diabetes mellitus (DM), wrist trauma, hypertension (HTN), pregnancy, and amyloid neuropathies (7). Symptoms often include burning pain, numbness, paresthesia, and in more advanced stages, muscle atrophy in the thenar region and decreased grip strength. These symptoms typically intensify at night and during functional wrist movements, affecting the thumb, index, middle, and radial side of the ring finger (8). The underlying mechanisms may involve increased compartmental pressure from synovial tissue hypertrophy or ischemic damage to the median nerve following trauma (9).

Occupational factors such as repetitive wrist motions, awkward postures, prolonged static positioning, lifting heavy objects, and the use of vibrating tools have been strongly linked to the development of CTS (10). Biomechanically, the structure of the carpal tunnel is highly dynamic; wrist joint activity significantly alters the tunnel's dimensions due to the mobility of its bony walls, further exacerbating median nerve compression during normal wrist movements (11). Among the affected occupations, retail store cashiers represent a particularly vulnerable group. The repetitive scanning motions, prolonged standing, awkward wrist postures, and occasional lifting of heavy items place considerable strain on their upper limbs (10,11). Despite their high-risk occupational exposure, there remains a noticeable gap in the literature concerning the prevalence of CTS in this population, especially in developing regions like Pakistan. Clinically, diagnosis is supported by provocation tests such as Phalen’s, Tinel’s, and Durkan’s, while reverse Phalen’s test serves as a relief test (12). Confirmation is often achieved through nerve conduction studies (NCS) and electromyography (EMG), with ultrasound being a supplementary imaging modality (13). Anatomically, the carpal tunnel contains the median nerve along with nine tendons, including those of the flexor digitorum superficialis and profundus, and the flexor pollicis longus. The median nerve lies superficially under the transverse carpal ligament and gives rise to the motor branch that innervates the thenar muscles.

Globally, the prevalence of CTS among high-risk occupational groups varies widely, from 8.4% in the United States to as high as 74.3% in Turkey, with intermediate rates reported in Malaysia (16.2%), Iran (16.7%), Saudi Arabia (30.5%), and multiple cities in Pakistan including Peshawar (15.5%), Karachi (10.13%), and Lahore (15.5%) (6). Prevalence among butchers has also been documented in Pakistan. However, there remains a notable absence of empirical data on the prevalence of CTS among retail store cashiers in Karachi, despite their occupational exposure being comparable to other high-risk professions. Given this significant knowledge gap, this study aims to determine the prevalence of carpal tunnel syndrome among retail store cashiers in Karachi, Pakistan. The objective is to provide evidence-based insights into the occupational health risks faced by this understudied population, while also emphasizing the necessity for ergonomic interventions and preventive strategies in the retail sector.

METHODS

This observational cross-sectional study was conducted to assess the prevalence of carpal tunnel syndrome (CTS) among retail store cashiers in Karachi. The study spanned a period of six months following ethical approval from the Institutional Review Board of the respective institution. Prior to participation, written informed consent was obtained from all subjects, ensuring voluntary involvement and confidentiality of their personal data throughout the research process. A total of 191 retail store cashiers were selected using a non-probability convenient sampling technique. Participants included both male and female individuals aged between 18 and 40 years, with at least one year of continuous employment in cashier roles involving manual handling of items and repetitive wrist-intensive tasks,

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such as scanning, registering, and lifting items without reliance on fully automated systems. The inclusion criteria specifically targeted cashiers using conventional point-of-sale methods requiring repetitive wrist movements. Individuals were excluded if they were pregnant, had recent wrist fractures, congenital upper limb deformities such as Madelung deformity or radial club hand, or were diagnosed with diabetes-related neuropathy to control for external neuropathic influences.

Data were collected using a structured questionnaire composed of three sections. The first section captured demographic and occupational data, including age, gender, work experience, and daily working hours. The second section comprised the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ), a validated instrument that evaluates both symptom severity and functional impact associated with CTS. The third section utilized the Visual Analogue Scale (VAS) to measure subjective pain intensity on a scale of 0 to 10, where higher scores indicated greater pain. The collected data were reviewed for completeness and consistency, then coded and entered into IBM SPSS Statistics version 26 for statistical analysis. Descriptive statistics were applied to summarize participant characteristics. Inferential statistics, including chi-square tests, were employed to examine associations between CTS symptoms and variables such as age, gender, and occupational duration. Correlation analyses were performed to explore the relationship between pain intensity and symptom severity.

RESULTS

Out of the total 191 retail store cashiers included in the study, the majority were male (n = 176; 92.1%), while a smaller proportion were female (n = 15; 7.9%). The participants' ages ranged between 18 and 40 years, with the largest age group being 34–40 years (n = 75; 39.3%), followed by 26–33 years (n = 65; 34.0%), and 18–25 years (n = 50; 26.2%). Only one participant (0.5%) was above 40 years of age. Based on the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ), the prevalence of carpal tunnel syndrome among the sample population was 21.5%, with 41 participants identified as having CTS. Regarding work-related factors, most participants (n = 145; 75.9%) reported working 40 or more hours per week. A significant proportion (n = 69; 36.1%) had over 7 years of work experience, while others had 6–7 years (23.6%), 4–5 years (20.4%), 2–3 years (17.8%), and less than 2 years (2.1%) of experience. Symptom severity, as assessed by BCTSQ's Symptom Severity Scale, revealed that 62.3% of participants rated nighttime wrist pain as minimal (score of 1), while 11.5% reported moderate pain (score of 3 or 4), and 2.1% reported severe pain (score of 5). Similar patterns were noted in the frequency of nighttime wrist pain disturbing sleep, where 66% reported no disturbance, and 21.5% reported varying degrees of disruption. Daytime wrist pain was present in 49.7% of respondents, with 50.3% denying any pain. Approximately 43.5% of participants reported some level of numbness, while 40.3% reported varying degrees of hand weakness. Tingling sensations were reported by 33% of participants, with 32.5% experiencing some severity at night. Difficulty gripping or holding small objects was noted by 36.6% of participants.

Functional status outcomes demonstrated that most participants had no difficulty performing daily tasks. Writing was unaffected in 64.9% of participants, and 72.3% had no trouble buttoning clothes. Tasks such as holding a book, gripping a phone, opening jars, and carrying groceries were performed without difficulty by over 64% of the participants. Basic activities like bathing and dressing were reported as easy by 75.4% of the sample. Mild to moderate functional limitations were observed in a small percentage of individuals. Pain intensity assessed using the Visual Analogue Scale (VAS) showed that of the 41 individuals diagnosed with CTS, 18 reported moderate pain, 9 reported severe pain, 2 experienced very severe pain, and 2 reported worst possible pain. Pearson correlation analysis demonstrated a strong positive correlation between CTS symptom severity and functional impairment ($r = 0.970$, $p < 0.001$), indicating that greater symptom intensity was closely associated with decreased functional ability. A statistically significant but weak negative correlation was found between symptom severity and work-related variables ($r = -0.170$, $p = 0.018$), suggesting that increasing symptom severity modestly affected work outcomes. Chi-square analysis revealed no statistically significant association between pain severity and gender ($p = 0.093$), but a significant association was found between age and pain severity ($p = 0.037$), indicating that older individuals experienced more severe CTS symptoms. Among the 41 individuals diagnosed with carpal tunnel syndrome (CTS), further analysis revealed that the majority experienced moderate levels of pain, with 18 reporting moderate discomfort, 9 reporting severe pain, 2 experiencing very severe pain, and another 2 reporting the worst possible pain. Based on the Visual Analogue Scale (VAS), the mean pain score among CTS cases was calculated as 3.61 with a standard deviation of 0.88, indicating a tendency toward moderate pain with relatively low variability.

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Table 1 Shows demographic data of participants

Variables		Frequency	Percent %
Gender	Male	176	92.1
	Female	15	7.9
	Total	191	100
Age	18-25	50	26.2
	26-33	65	34.0
	34-40	75	39.3
	41 and above	1	.5
	Total	191	100

Table 2 Shows work related demographic data of participants

Variables		Frequency	Percent %
Years of experience	less than 2 years	4	2.1
	2-3 years	34	17.8
	4-5 years	39	20.4
	6-7 years	45	23.6
	more than 7 years	69	36.1
	Total	191	100
Average work hours per week	less than 20 hours	7	3.7
	20 to 29 hours	11	5.8
	30to39 hours	28	14.7
	40 and above	145	75.9
	Total	191	100.0

Table 3 Shows symptom severity of CTS using BCTQ

Variables	Frequency				
Symptoms Severity Scale (11 items)	1	2	3	4	5
1. Rate the severity of wrist pain that you experience at night?	119 (62.3%)	22 (11.5%)	37 (19.4%)	9 (4.7%)	4 (2.1%)
2. Frequency of wrist pain that disturbed your sleep at night during last 2 weeks?	126 (66%)	15 (7.9%)	24 (12.6%)	22 (11.5%)	4 (2.1%)
3. Do you experience usual pain in your hand or wrist during the daytime?	96 (50.3%)	52 (27.2%)	33 (17.3%)	6 (3.1%)	4 (2.1%)
4. Frequency of wrist pain during the daytime?	96 (50.3%)	52 (27.2%)	22 (11.5%)	17 (8.9%)	4(2.1%)
5. Average pain episode lasting during the daytime?	101 (52.9%)	46 (24.1%)	31 (16.2%)	9 (4.7%)	4 (2.1%)
6. Presence of numbness (loss of sensation) in hand?	108 (56.5%)	41 (21.5%)	32 (16.8%)	6 (3.1%)	4(2.1%)
7. Presence of any weakness in hand?	114 (59.7%)	35 (18.3%)	29 (15.2%)	9 (4.7%)	4 (2.1%)
8. Presence of any tingling sensations in hand?	128 (67%)	18 (9.4%)	34 (17.8%)	8 (4.2%)	3 (1.6%)

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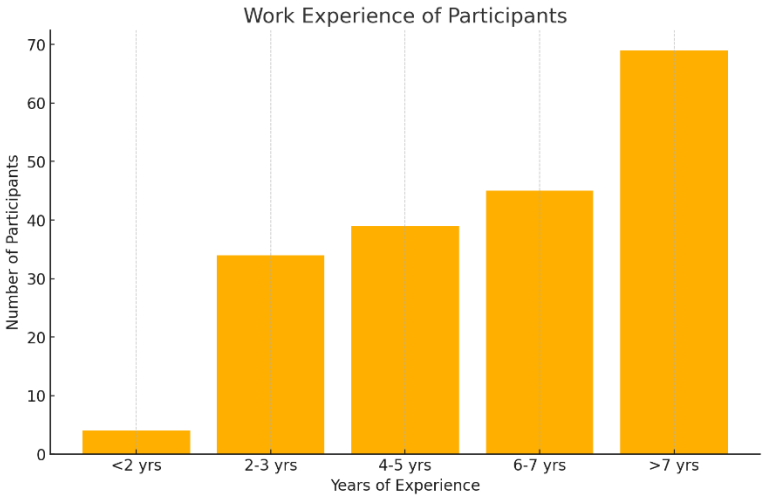
Variables	Frequency				
9. Severity of numbness or tingling at night?	129 (67.5%)	18 (9.4%)	33 (17.8%)	8 (4.2%)	3 (1.6%)
10. Frequency of numbness or tingling that disturbed your sleep in the last two weeks?	130 (68.1%)	11 (5.8%)	29 (15.2%)	17 (8.9%)	4 (2.1%)
11. Difficulty in gripping and holding small objects?	121 (63.4%)	26 (13.6%)	32 (16.8%)	8 (4.2%)	4 (2.1%)

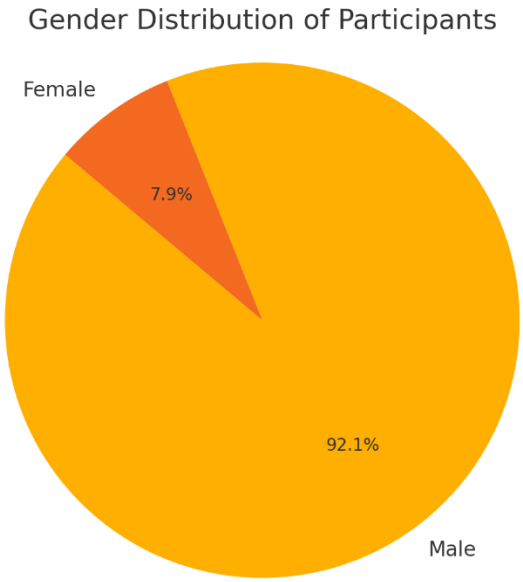
Table 4 Shows functional status of CTS using BCTQ

Variables	Frequency				
Functional Status Scale (8 items)	1	2	3	4	5
1. Writing	124 (64.9%)	21 (11%)	36 (18.8%)	8 (4.2%)	2 (1%)
2. Buttoning clothes	138 (72.3%)	11 (5.8%)	30 (15.7%)	10 (5.2%)	2 (1%)
3. Holding book while reading	130 (68.1%)	21 (11%)	32 (16.8%)	7 (3.7%)	1 (0.5%)
4. Gripping telephone handle	128 (67%)	22 (11.5%)	30 (15.7%)	10 (5.2%)	1 (0.5%)
5. Opening jars	128 (67%)	23 (12%)	28 (14.7%)	12 (6.3%)	0
6. Carrying grocery	123 (64.4%)	23 (12%)	34 (17.8%)	10 (5.2%)	1 (0.5%)
7. Household chores	117 (61.3%)	28 (14.7%)	36 (18.8%)	8 (4.2%)	2 (1%)
8. Bathing and dressing	144 (75.4%)	8 (4.2%)	29 (15.2%)	8 (4.2%)	2 (1%)

Table 5 VAS Pain Levels in CTS Cases

VAS Pain Level	CTS Cases
Moderate	18
Severe	9
Very Severe	2
Worst	2





DISCUSSION

The findings of this study offer significant insight into the occupational burden of carpal tunnel syndrome (CTS) among retail store cashiers in Karachi, underscoring the clinical and functional implications of repetitive wrist activity in this profession. With a CTS prevalence of 21.5% identified through the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ), the results align with previous studies conducted on workers exposed to repetitive wrist and hand movements, such as data entry clerks, assembly line workers, and manual laborers (14). The occupational duties of cashiers, which involve continuous scanning, handling of items, and maintaining fixed postures, place considerable biomechanical stress on the wrist structures, predisposing them to median nerve compression. While the sample was predominantly male (92.1%), no statistically significant association was found between gender and symptom severity ($p = 0.093$) (15). The minimal representation of females (7.9%) may have limited the detection of gender-related trends. Previous literature has highlighted a greater predisposition to CTS in women, attributed to anatomical and hormonal differences, and comorbid conditions such as diabetes and thyroid dysfunction. These disparities indicate the importance of future studies incorporating balanced gender representation to explore sex-specific risk profiles more comprehensively (16).

Age demonstrated a significant association with symptom severity ($p = 0.037$), with older participants reporting more intense symptoms. Although only a small fraction of the sample was above 40 years, these individuals displayed heightened vulnerability, potentially due to age-related physiological changes such as reduced nerve conduction velocity, decreased connective tissue elasticity, and chronic low-grade inflammation (17). This observation supports cumulative trauma theories, which posit that prolonged exposure to occupational stressors results in progressive musculoskeletal damage over time (18). It further emphasizes the value of early ergonomic intervention in younger workers and tailored workload adaptations for aging employees. The study revealed that a substantial proportion of participants (36.1%) had more than seven years of work experience, and 75.9% reported working over 40 hours per week. These findings

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highlight chronic occupational exposure as a probable contributor to the development and progression of CTS. Prolonged repetitive movements, particularly without ergonomic support, intensify pressure within the carpal tunnel, fostering inflammation and mechanical compression of the median nerve (16,17). The negative correlation observed between symptom severity and work-related outcomes ($r = -0.170$, $p = 0.018$) supports previous evidence that associates CTS with reduced productivity and occupational limitations (6,7). Pain and functional impairment assessments using the BCTSQ revealed that most participants experienced mild to moderate symptoms, particularly during nocturnal hours. Nighttime symptoms such as tingling, numbness, and pain are characteristic of CTS, often exacerbated by wrist flexion during sleep, which increases intra-tunnel pressure (19). Although daytime symptoms were less intense, even mild sensory disturbances like paresthesia or intermittent pain may impact task performance in repetitive work settings. Weakness was the least reported symptom, consistent with the early stages of CTS, where sensory symptoms precede motor deficits (20).

Functional status findings indicated minimal hindrance in most activities of daily living, with the majority reporting no limitations in tasks such as writing, dressing, or gripping objects. These results suggest that the condition was predominantly at a mild or early stage in most affected individuals, possibly reflecting early detection due to symptom awareness and the structured use of standardized tools like the BCTSQ (19,20). Nevertheless, the subclinical impact on efficiency and endurance remains a concern in occupations requiring continuous manual performance. Despite its strengths, this study faced certain limitations. Reliance on self-reported data through questionnaires such as the BCTSQ and Visual Analogue Scale (VAS) may have introduced subjectivity and recall bias, which could affect symptom accuracy. Furthermore, the absence of confirmatory diagnostic tools like nerve conduction studies limits the clinical validation of CTS diagnoses, increasing the risk of misclassification. Another limitation was the lack of in-depth assessment of ergonomic setups, task intensity, and variability of work roles within the cashier group, which may have provided greater insight into contributing occupational factors. Nonetheless, the study holds several strengths. It addresses an occupational group frequently overlooked in musculoskeletal research—cashiers in low-resource urban environments. The regional focus on Karachi, Pakistan, adds contextual relevance, as developing countries often lack occupational health surveillance systems. This study also underscores the importance of ergonomic awareness and highlights the need for preventive strategies tailored to high-risk professions. Future research should involve larger, randomized samples to improve representativeness and incorporate objective diagnostic techniques, such as nerve conduction velocity testing, to strengthen the accuracy of CTS detection. Longitudinal cohort studies may provide valuable information on the progression of CTS in relation to occupational exposures. Additionally, evaluating the impact of ergonomic interventions—such as improved workstation designs, scheduled rest breaks, and physical conditioning—would be essential in developing sustainable strategies to prevent CTS in high-risk occupational sectors.

CONCLUSION

This study highlights the occupational health burden posed by carpal tunnel syndrome among retail store cashiers, emphasizing the link between repetitive wrist movements and the development of CTS symptoms. The findings underscore the importance of prioritizing ergonomic practices in retail environments to protect worker health and maintain productivity. Implementing preventive strategies such as regular breaks, ergonomic workstation adjustments, and employee education on proper wrist positioning can play a vital role in minimizing the risk of CTS. The study also points to the need for continued research to better understand occupation-specific risk factors and evaluate the effectiveness of targeted interventions. Overall, these insights reinforce the urgent need for collaborative efforts among employers, healthcare professionals, and policymakers to promote safer working conditions and long-term occupational well-being.

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Author Contribution

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Sidra Asra Masroor	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rishika Ropeta	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Ukesh Kumar	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Vishal Kumar	Writing - Review & Editing, Assistance with Data Curation
Aisha Ijlal*	Writing - Review & Editing, Assistance with Data Curation

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