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Original Article

Prevalence and Associated Factors of Carpal Tunnel Syndrome Among Manual Weavers in Addis Ababa, Ethiopia: Cross-Sectional Study

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Abstract

Background: *Carpal tunnel syndrome (CTS) is a prevalent neuropathy caused by factors like thickened flexor tendon sheath, skeletal encroachment, edema, or soft tissue mass compressing the median nerve at the wrist. Manual weaving is a common method of producing traditional clothing in Ethiopia. The purpose of this study is to assess the prevalence and risk factors of carpal tunnel syndrome among manual weavers in Addis Ababa, Ethiopia.*

Methods*: A cross-sectional study was conducted. Data were collected via the open data kit (ODK) along with Kobo Toolbox server. Finally, data were analyzed using Statistical Package for Social Science (SPSS) version 25. Participants who were positive for both the Phalen's and compression tests were considered positive for carpal tunnel syndrome. The strength of association was determined using an adjusted odds ratio (AOR) with a 95% confidence interval. In the multivariable binary logistic regression, statistical significance was declared at p<0.05.*

Results: *The prevalence of carpal tunnel syndrome among manual weavers in Addis Ababa was 14.7% (95% CI; 11.5-18.4). 15.2% (95% CI; 11.9-18.9) of the study participants were positive for Phalen's test and 19.9 % (95% CI; 16.2-24.0) of the participants were positive for the compression test. Frequency of taking a break [AOR=2.64; 95% CI; 1.06, 6.58], co-morbidities [AOR=2.76;95% CI;1.02,7.51] and alcohol history [AOR=1.97;95% CI;1.09,3.57] had statistically significant association. From the cases (n=62) most of them (90.3%) had complained of at least one sensory symptom.*

Conclusion*: Carpal tunnel syndrome is prevalent among manual weavers, and it is significantly associated with not taking frequent breaks during weaving, comorbidities, and alcohol consumption. Sensory symptoms (tingling, numbness, and nocturnal pain) were more common in manual weavers than motor weakness symptoms.*

Keywords*: Carpal tunnel syndrome, Compression test, Phalen's test, Symptom severity scale, Functional severity scale*

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Introduction

Carpal tunnel syndrome is well-known entrapment neuropathy, which occurs when a thickened flexor tendon sheath, skeletal encroachment, edema, or soft tissue mass compresses the median nerve at the wrist (1).

The presence of symptoms, physical findings, positive nerve conduction tests, and provocative tests such as Tinel's and Phalen's signs are all used to diagnose carpal tunnel syndrome (3).

To establish a diagnosis of work-related carpal tunnel syndrome, it is necessary to identify the occupational activities that could have contributed to the development of the syndrome. Activities conducted by weavers include wrist extension and flexion; repeated grasping of objects involving more than two fingers, and so on. Manual weaving is a common method of producing traditional clothing in Ethiopia. Shiro-meda (Gundshmeda), Adisugebeya, and Kechenemedhani-

alem are the study areas, which are the most common places in Addis Ababa where many weavers work.

Various studies have looked at the prevalence of carpal tunnel syndrome in various occupations around the world. According to Colorado State University research, the prevalence of CTS among dairy parlor workers was 16.6% (6).

According to a cross-sectional study of laboratory staff at King Saud University Hospital in Saudi Arabia, the prevalence of carpal tunnel syndrome is 25.3% (5). CTS were found in 5.79% of computer users at Mosul University in Iraq. As a result, carpal tunnel syndrome is common in a variety of occupations that require repetitive flexion and extension of the wrist joint. However, no published research on the prevalence of CTS among manual weavers has been conducted.

The study was the first of its kind in Ethiopia and in the Africa region, where weaving work is common.
The data generated from this study could be used as a foundation for future research in similar areas. The findings of this study will also be important for ergonomists to research manual weavers to determine whether ergonomic factors play a role in the development of CTS.
The aim of this study was to investigate the prevalence and risk factors of carpal tunnel syndrome among manual weavers in Addis Ababa, Ethiopia.

Methods and Materials

Study area and study period

This study was carried out from November 13, 2021, to January 7, 2022, in Addis Ababa City, where clustered weaving activities were done. Shiromeda, Adisu Gebeya, and Kechene Medhane Alem are the top areas where weavers are found in a clustered manner. Addis Ababa is the capital and largest city of Ethiopia.

There are 57 enterprises in ShiroMeda (Gundshmeda), which contain an average of 1400 manual weavers. There are 13 enterprises in the Addisu Gebeya area where, on average, 260 manual weavers were found, and around the Kechene Medhanialem, there are 12 enterprises in which an average of 240 manual weavers were included.

Study design and participants

A cross-sectional study design was conducted among manual weavers who were registered by the Addis Ababa city administration as enterprises and fulfilled the eligibility criteria.

Eligibility Criteria

We included manual weavers who have worked for at least 12 months as manual weavers. Weavers utilizing modern and advanced automatic machines were excluded. Weavers who have trauma or have a history of trauma recently at the shoulder and/or neck and/or arm and/or forearm were also excluded from this study.

Sample size determination

The sample size was computed based on a single proportion population formula with a prevalence of 50%. Because there is no previous similar study conducted in Ethiopia, taking the margin of error of 5%. The researcher took a 10% non-respondent rate which is 38.4 and the total sample size was 423.

Sampling procedure

There are three sites in Addis Ababa where manual weaving enterprises were found: Shiromeda (Gundshmeda), AddisuGebeya, and Kechenemedhanialem (Figure 1). The sample size was allocated proportionally to the three sites based on the total number of manual weavers. The names of weavers in each enterprise were registered and coded based on alphabetical order. Then, the participants were selected using a simple random technique by using alphabetical order-based codes as a sampling frame. Computer-generated random numbers were used to select the participants. The total number of manual weavers who had been registered was 1900.

Study variables

The dependent variable for this study was developing carpal tunnel syndrome. The independent variables were socio-demographic factors (gender, age, marital status, and educational status) and clinical and work-related factors (weaving work experience, frequency of taking breaks, mostly used hands, body mass index, comorbidities, alcohol history, and smoking history).

Operational definitions

Carpal tunnel syndrome: defined as the presence of pain at the wrist joint, hand, or forearm, in addition to paresthesia that worsens at night and is positive for Phalen's test and compression test.

Paresthesia: is defined as the presence of numbness and tingling at the radial side of the palm and 3 or 4 radial side fingers.

Data collection tools and procedure

Data were collected using a structured questionnaire by trained health professionals. Three trained data collectors were involved. The questionnaire had three parts. The first part had basic socio-demographic information; the second part had information about factors related to CTS; and the third part had a physical examination sheet. On the physical examination sheet, provocative tests were included to diagnose carpal

tunnel syndrome clinically. A combination of Phalen's test and the compression test increases the reliability of the data. Because when we combine these provocative tests, we can get 92% of specificity and sensitivity (33). The severity scaling was performed using the Boston carpal tunnel syndrome questionnaire (BCTQ) (11).

Data presentation and analysis

The data was collected and entered using Open Data Kit (ODK) version 2021.2.4 software along with the **Kobo Toolbox** server to store the collected data and exported into SPSS version 25 for statistical analysis. Descriptive statistics like mean, standard deviation, median, interquartile range, and percentage were executed based on the nature of the data after checking the normal distribution. The data was presented with narration, tabulation, and a graphical presentation.

The association between independent variables and CTS was determined using binary logistic regression. The "Hosmer and Lemeshow" test was done to test model fitness. First a bivariable analysis was performed on each of the selected indicators for the data-set. Then, any variable of $p<0.25$ was entered into multivariable analysis to identify variables that had a statistically significant association with CTS ($p<0.05$). The strength of the association was determined by computing the crude odds ratio (COR) and adjusted odds ratio (AOR) with a 95% confidence interval.

Data quality control

To ensure the quality of the data, pre-testing of the questionnaire was conducted among 13 respondents, which was equivalent to 5% of the total sample size. The data was collected by a data collector who has good skill in performing a physical examination. The Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) was used, which is a globally accepted standard tool to diagnose carpal tunnel syndrome. Appropriate training was given to the data collectors by a senior orthopedist. To diagnose carpal tunnel syndrome and to avoid false positive reports, a combination of at least two provocative tests was conducted in addition to signs and symptoms. To manage the data properly, the researcher used ODK for collecting and exporting data to SPSS for data analysis.

Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee (REC) of the School of Medicine, College of Medicine and Health Sciences, Addis Ababa University. Before collecting the data, informed consent was obtained from each study participant. Potential identifiers were not described in the questionnaire to ascertain confidentiality and the data collected was placed in a secured place. The information collected from the study participants was kept confidential and used solely for research purposes.

Results

Socio-demographic characteristics of study participants

In this study, a total of 422 manual weavers participated, resulting in a response rate of 99.7%. The median (IQR) age of the study participants was 30.1 (8) years. As shown in Table 1, the participants ranged in age from 20 to 64 years old. Most of the participants, 150 (35.5%), were in the age category of 26–30 years. Males represent 79.6% of the study participants. The majority (87.7%) of the study participants in this study were married. Regarding their educational status, 43 (10.2%) of the study participants had no formal education, while the remaining 89.8% had completed primary school or above.

Table 1: Socio-demographic characteristics of manual weavers working in Addis Ababa , 2022.

Variables	Categories	Frequency	Percentage %
Sex	Male	336	79.6
	Female	86	20.4
Age	20-25	78	18.5
	26-30	150	35.6
	31-35	96	22.8
	36-40	55	13.0
	41-45	24	5.7
	46-50	13	3.1
	>50	6	1.4
Marital status	Currently married	370	87.7
	Currently unmarried	52	12.32
Educational status	No formal education	43	10.2
	1^0 Education	192	45.5
	2^0 Education	149	35.3
	College or above	38	9.0

Clinical and work-related characteristics of study participants

The weaving work experience of study participants ranged from 2 to 46 years. The median (IQR) of waving work experience was 10 (6) years. As shown in Table 2, more than half (57.1%) of the respondents had weaving work experience of <10 years. Out of the total study participants, 353 (79.6%) take breaks only at lunch, while 86 (20.4%) of the subjects take breaks every four hours. The majority of manual weavers (95%) were right-handed, with only 5% being left-handed. Regarding their clinical history, 7.1% of the participants had comorbid diseases, 42.7% drank alcohol, and 2.1% were smokers. Almost all of the participants (98.3%) were in the normal BMI range.

Table 2: Clinical and work-related characteristics of manual weavers who work in Addis Ababa.

Variables	Categories	Frequency	Percentag
Weaving work experience (in years)	<10 years	241	57.1
	10-20 years	150	35.5
	>20 years	31	7.3
Frequency of taking break	Only at lunch	336	79.6
	Every 4 hours	86	20.4
Mostly used hand	Right	401	95
	Left	21	5
BMI	Underweight	6	1.4
	Normal	413	98.3
	Overweight	1	0.2
Comorbidity	Yes	30	7.1
	No	392	92.9
Alcohol	Yes	180	42.7
	No	242	57.3
Smoking	Yes	9	2.1
	No	413	(97.9)

Prevalence of carpal tunnel syndrome

The prevalence of CTS among manual weavers in Addis Ababa was 14.7% (95% CI: 11.5–18.4). Among the participants included in this study, those who were positive for Phalen's test and compression test were considered to have CTS. Of the total respondents, 15.2% (95% CI: 11.9–18.9) of them were positive for Phalen's test, and 19.9% (95% CI: 16.2-24.0) of the participants were positive for the compression test (Table 3).

The prevalence of CTS demonstrated a variation in sex, age, and other predictor variables. It was higher among females (16.3%) than males (14.3%). Similarly, the prevalence was higher in the age categories of 36–40 years (3.8%) and married (14%). From the 401 right-handed study participants, 56 (13.9%) were positive for CTS. Out of the 62 CTS-positive subjects, 58 (93.5%) took a break only at lunchtime. Similarly, CTS was found in 28% of those with comorbid conditions and 21.74% of those who drank alcohol. From the study participants who had more than 20 years of weaving work experience (n = 31), 7 (22.6%) were positive for CTS. Whereas only 21.9% of individuals with 10–20 years of experience and 9.84% of those with <10 years of experience, respectively, were positive for CTS (Table 2). As indicated in Figure 2, from the total respondents, those with weaving experience of 10–20 years account for 7.1%.

Table 3 : Prevalence of carpal tunnel syndrome among manual weavers.

Variables	Category	Frequency	%	Prevalence	95% CI
Phalen's Test	Positive	64	15.2	15.2%	11.9-18.9
	Negative	358	84.8		
Compression Test	Positive	84	19.9	19.9%	16.2-24.0
	Negative	338	80.1		
Carpal Tunnel Syndrome	Positive	62	14.7	14.7%	11.5-18.4
	Negative	360	85.3		

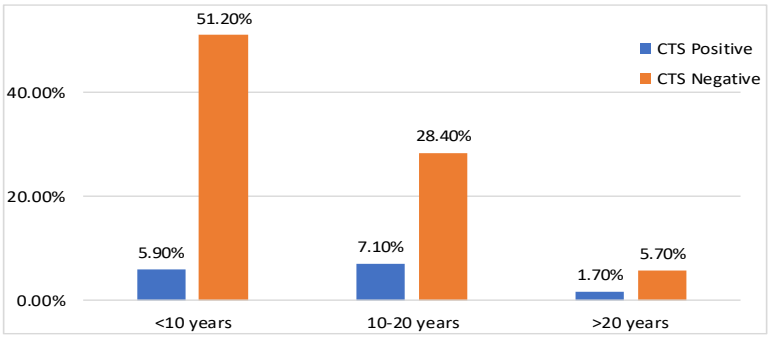

Figure 2: Carpal tunnel syndrome based on the different period of weaving work experience among manual weavers in Addis Ababa, 2022.

Symptom and functional severity scale of carpal tunnel syndrome

The symptom severity scale (SSC) ranged from a minimum of 11 to a maximum of 25. The functionality severity scale ranged from 8 to 16. The mean (SD) of SSC and FSC was 17.77 (3.84) and 8.98 (1.85), respectively (Table 4).

Among the carpal positive study participants (n = 62), 56 (90.3%) had nocturnal pain, 34 (54.8%) woke up at least once during the night due to the pain, 25 (40.3%) had hand or wrist pain during the daytime, 51 (82.3%) had numbness in the hand, 50 (80.6%) had a tingling sensation in their hand, 35 (56.5%) had weakness in their hand or wrist, and 12 (19.4%) had difficulty grasping.

The three categories (mild, moderate, and severe) of CTS symptoms were based on the SSS and FSS. Individuals suspected of having mild, moderate, and severe CTS symptoms were in the 50th percentile, in the 50-75th percentile, and above the 75th percentile, respectively. This classification was the same for FSS 5. Based on this classification, as shown in Figure 3, out of the CTS-positive subjects (n = 62), 26 (41.9%) had mild symptoms, 34 (54.8%) had moderate symptoms, and 2 (3.2%) had severe CTS symptoms. Similarly, 39 (62.9%) had mild functional difficulty, 22 (35.5%) had moderate difficulty in function, and 1 (1.6%) had severe functional difficulty.

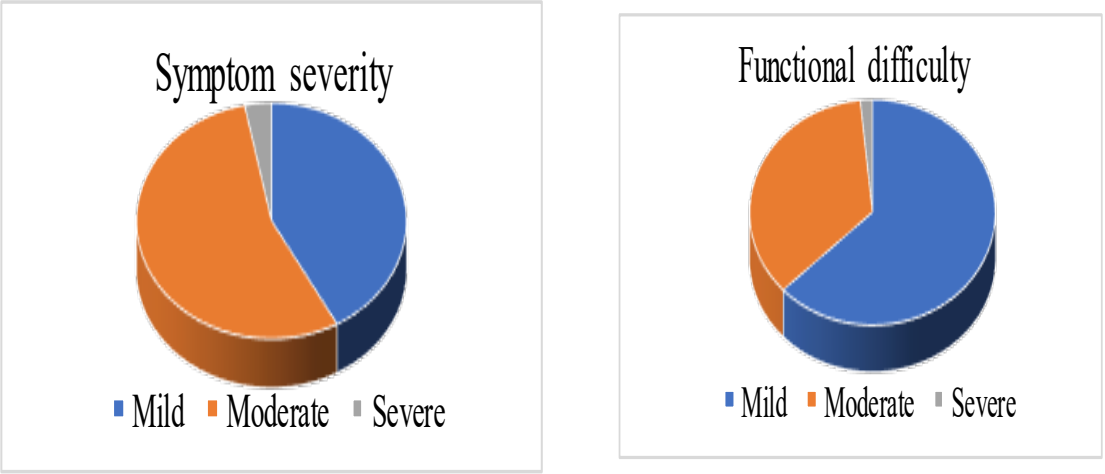

Figure 3: Distribution of Symptom Severity Scale and Functional Severity Scale Categories.

A comparison of the mean SSS and FSS of CTS-positive study participants using the different predictors showed that the mean SSS was not statistically different between males and females. While the mean FSS of females (9.93±2.9) was significantly higher than males (8.71±1.3), which showed that females had more functional difficulty than males due to CTS, After checking the assumptions, a one-way ANOVA was conducted to compare the mean SSS and FSS between the different categories of weaving work experience.

Study participants who had more than 20 years of experience had a statistically significant mean SSS difference with those participants with less than 10 years of experience (mean difference = 2.71, p-value = 0.031).

But the mean FSS difference between the two groups was statistically insignificant. Moreover, subjects who consume alcohol (18.81±3.6) had a statistically higher SSS than those who don't consume alcohol (16.05±3.7).

Table 4: Symptom severity scaling (SSS) and functional severity scaling (FSS) among CTS positive manual weavers in Addis Ababa

Variable	Category	SSS mean (SD)	t-value/ F-value	p-value	FSS mean (SD)	t-value/F-value	p-value
Sex	Male	17.52(3.7)	0.961	0.341	8.71(1.3)	-2.24	0.029
	Female	18.64(4.5)			9.93(2.9)		*
Work Experience	<10 year	16.15(2.5)	4.45	0.031*	8.11(0.6)	2.27	0.105
	10-20 year	17.41(3.0)			8.23(1.0)		
	>20 year	18.86(4.1)			8.48(2.2)		
Handedness	Right	17.7(3.8)	-0.48	0.630	8.91(1.7)	-0.950	0.346
	Left	18.5(4.2)			9.67(3.1)		
Alcohol History	Yes	18.81(3.6)	2.60	0.012*	9.08(1.6)	-0.490	0.623
	No	16.05(3.7)			8.85(2.1)		
Comorbidity	Yes	19.29(3.4)	1.12	0.273	9.05(1.9)	0.841	0.404
	No	17.58(3.9)			8.43(0.5)		
Frequency Of Breaking time	Only at lunch	18.29(5.6)	0.371	0.712	9.14(2.3)	0.239	0.812
	Every 4 hours	17.71(3.6)			8.96(1.8)		

* Significant at p-value <0.05

Factors associated with carpal tunnel syndrome

Mostly used hand, frequency of break time, educational status, and history of alcohol and co morbidity were taken as candidate variables for multivariable logistic regression at a p-value ≤ 0.25. The output from multivariable binary logistic regression showed waving work experience, co morbidity, less frequent break time, and alcohol were associated with carpal tunnel syndrome after adjustment to confounding variables.

Study participants with more than 20 years of weaving work experience had 3.89 times higher odds of having carpal tunnel syndrome (AOR = 3.89, 95% CI, 1.28–11.76, p = 0.016) than those with less than 10 years of experience, provided that the other variables were kept constant. Similarly, the odds of having carpal tunnel syndrome among participants with 10–20 years of weaving work experience were 2.69 (AOR = 2.69; 95% CI: 1.36–5.34, p = 0.004) times higher than those with less than 10 years' experience.

Keeping the other variables constant, participants who reported taking a break only at lunch were 2.64 times more likely to have CTS than those who took a break every four hours (OR: 2.64; 95% CI: 1.06–6.58, p = 0.038). The odds of CTS in current alcohol users were 1.97 times higher than those who did not drink alcohol (AOR: 1.97, 95%CI: 1.09–3.57, P = 0.025). Moreover, study participants who had comorbid conditions had 2.76 times higher odds of having CTS than those without any comorbid diseases (AOR, 2.76, 95% CI, 1.02-7.51) (Table 5)

Discussion

This study tried to assess the prevalence of carpal tunnel syndrome (CTS) and its associated factors among 422 manual weavers using an interviewer-administered questionnaire. A physical examination was also done to perform Phalen's and compression tests. The prevalence of CTS among manual weavers was 14.7% (95% CI, 11.5%–18.4%). The result of the current study was comparable to a study carried out in Kuwait among office workers (18.7%) and Iran (19.4%) among carpet weavers. The prevalence in this study was lower than in other studies conducted in Turkey (21.2%) (17), India (21.5%) (39), Saudi Arabia (25.3%) (5), and Iraq (36.2%) (1). In contrast, it was higher than the study conducted in China among office workers (9.6%) (40) and in the USA (8.7%; 41) among poultry processing workers. Our finding was also higher than other studies conducted in Sweden (14.4%) and Japan (4.7%) among the general population.

The possible explanation for the discrepancy in prevalence could be the difference in the study population. The Japanese study was conducted among the general population, which might reduce the prevalence. Whereas the study in Iraq was among computer users who were susceptible to CTS due to the repetitive wrist and hand movement nature of their work. Another possible reason for the discrepancy could be the method of assessment used to diagnose CTS. In the present study, CTS was diagnosed with clinical assessment and physical examination (Phalen's test and compression test). While the Iraqi and Turkish studies use nerve compression tests in addition to clinical assessment, which might increase the diagnosis of asymptomatic CTS,

Table 5: Bivariable and multivariable logistic regression analysis of carpal tunnel syndrome with its predictor variable among manual weavers working in Addis Ababa, 2022.

Variables	Category	Carpal Tunnel syndrome		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Sex	Female	14(3.32)	72(17.1)	1	1
	Male	48(11.4)	288(68.2)	0.86(0.45-1.64)	0.66(0.31-1.42)
Marital Status	Unmarried	3(0.71)	49(11.6)	1	1
	Married	59(13.98)	311(73.69)	3.09(0.94-10.27)	2.67(0.77-9.34)
Weaving work Experience	<10 years	25(5.9)	216(51.2)	1	1
	10-20 years	30(7.1)	120(28.4)	2.16(1.22-3.84) **	2.69(1.36-5.34) **
	>20 years	7(1.7)	24(5.7)	2.52(0.99-6.44) *	3.89(1.28-11.76) *
Mostly used hand	Left	6(1.4)	15(3.6)	1	1
	Right	56(13.3)	345(81.8)	2.46(0.92-6.62)	2.4(0.83-6.97)
Frequency of break per day	Every 4 hours	7(1.7)	79(18.7)	1	1
	Only at lunch	55(13.0)	281(66.6)	2.21(0.97-5.04) *	2.64(1.06-6.58) *
Educational Status	No formal education	6(1.42)	37(8.77)	1	1
	1^0 educations	37(8.77)	155(36.73)	1.47(0.58-3.75)	2.27(0.78-6.65)
	2^0 educations	16(3.79)	133(31.5)	0.74(0.27-2.03)	0.82(0.27-2.46)
	College and above	3(0.71)	35(8.29)	0.53(0.12-2.28)	1.08(0.21-5.56)
Alcohol History	No	26(6.2)	216(51.2)	1	1
	Yes	36(8.5)	144(34.1)	2.08(1.20-3.59) ***	1.97(1.09-3.57)*
Comorbidity	No	55(13)	337(79.9)	1	1
	Yes	7(1.7)	23(5.5)	1.87(0.76-4.55) *	2.76(1.02-7.51) *

*** significant at p-value <0.001 ** significant at p-value <0.01 * significant at p-value <0.05
Good of fitness test (Hosmer and Lemeshow test) p-value = 0.069

The current study revealed that the prevalence of CTS recorded among females (16.2%) was higher than males (14.3%). This finding agreed with the studies done in USA (7), Saudi Arabia (5), Iraq (1), and China (40), which report a higher rate of CTS in females than males. The possible reason for the higher rate of CTS in females could be due to the smaller tunnel size and additional daily work at home.

The prevalence of CTS in this study increased as the age increased; the rates also increased, with the highest prevalence in the age group of more than 45 years. This finding was in line with studies done in India (39) and Sweden (7).

Our study showed that the mean difference of SSS in relation to sex among CTS-positive participants had no statistically significant difference (t-value = 0.961; P-value = 0.0.34). This was in contradiction with the study conducted in Saudi Arabia (5), which found a significantly elevated SSS in females compared to males. However, contrary to the Saudi Arabian study, female individuals in this study had a statistically higher mean FSS than male participants (t-value = -2.24; P-value = 0.029). Therefore, females had higher difficulty of function. This might be since females do a lot of activities at home that require repetitive hand flexion and extension at the wrist joint. This may worsen FSS.

In this study, the mean difference of SSS in relation to weaving work experience in the three categories (<10, 10-20, and >20 years) was statistically significant (t = 4.45; p = 0.031), which is against a study conducted in Saudi Arabia (5), which states that the mean difference of SSS is not significant in relation to work experience. But like the Saudi Arabian study, the mean difference of FSS related to work experience was not statistically significant (t = 2.27; p = 0.105).

The mean difference of both SSS and FSS in relation to comorbidity, handedness, and frequency of taking a break was not statistically significant, with a P-value of 0.63, 0.27, and 0.71, respectively, for SSS and 0.34,

This study implied that among the carpal-positive study participants, 82.3% had numbness in the hand, 90.3% had nocturnal pain, and 80.6% had a tingling sensation in the hand. This was higher than the Saudi Arabian and Indian studies, which showed 61.4% and 30% numbness, 66.7% and 10% nocturnal pain, and 70.2% and 10% tingling, respectively. This finding was also higher than the Chinese (40) study, which discovered 60% numbness and 32% tingling. Among our CTS-positive participants, 19.4% had difficulty grasping, 40.3% had hand or wrist pain during the day, and 56.5% had weakness in their hand or wrist. This contrasted with the Saudi Arabian study, which reported 31.6% difficulty grasping, 82.5% of hand or wrist pain during the daytime, and 73.7% of weakness in the hand.

Weaving work experience and CTS were found to have a strong association in this study. Participants with 10–20 years of weaving work experience had 2.69 times higher odds of having CTS than those with 1–10 years of work experience. Participants with more than 20 years of weaving work experience had a 3.89 times higher risk than those with less than 10 years of weaving work experience. A cross-sectional study conducted in Iran among female carpet weavers reported similar findings (20). Which suggested that developing CTS is highly associated with weaving experience and active working time per day? In this study, estimating the association between CTS and active working time per day was difficult because almost all the study participants work 8 hours per day and 6 days a week.

According to this study, participants who reported only taking a break at lunch were 2.64 times more likely to have CTS than those who took a break every four hours. A study done among computer users in China (40) was comparable with our findings. It reports that working without a break was found to be associated with an increased prevalence of CTS.

According to our findings, the risk of CTS was 1.97 times higher in alcoholics than in non-drinkers. Similarly, a cross-sectional study conducted in France (42) and India (39) reported higher odds of CTS among alcoholics than their corresponding subjects.
According to our findings, having comorbidities (diabetes, rheumatoid arthritis, and goiter) raises the incidence of CTS by 2.76 times. A cross-sectional study of office employees in Kuwait accentuates our findings, revealing that participants with two comorbidities had an odds ratio of 3.3, while those with three comorbidities had an odds ratio of 14.9, according to the study (5).

Many earlier studies have revealed an association between DM and CTS (29, 30). Even though this study found an association between CTS and comorbidities (DM, RA, and goiter) in general, it did not establish a specific association between CTS and DM. This is due to the fact that we only had 6 (1.42%) known DM participants in this study, making statistical analysis challenging. Similarly, numerous prior investigations found an association between RA and goiter (21, 23–25, 33–35). It was also difficult to determine if there was any association or not, for the same reasons as DM.

Even though overweight and CTS had a strong association in prior studies (21, 26, 27), there was no such association in this study. This could be due to the respondents' socioeconomic position. Since obesity is more common in those with higher socio-economic levels, our participants were by default low-income. Because the participants in this study were manual hand weavers, they were classified as small businesses by the Addis Ababa city authority. These chances were provided for people who could not run their own business due to a lack of funds. As a result, most of the participants (413) (98.3%) have a normal BMI (18.5-24). Similarly, the Chinese (40) study stated that BMI was not a significant predictor of CTS.

The present study failed to show a significant association between smoking and educational status with CTS. This was since the number of observations for smoking was not sufficient to fit into an analytical analysis. This was contrary to the studies done in China (40), the UK (23), and India (39), which found a higher risk of CTS among smokers and a lower risk of CTS among those with higher educational levels.

Conclusion

The findings of this study implied that a high prevalence of clinically confirmed CTS was seen among manual weavers in Addis Ababa. The prevalence was higher among females than males. Those participants who do not take a break frequently show higher odds of CTS than those who take breaks frequently. Participants who had been working as manual weavers for a long time had higher odds of having CTS. Drinking alcohol and comorbidities (DM, RA, and goiter) were also highly associated with CTS.

Sensory symptoms (tingling, numbness, and nocturnal pain) were more common than symptoms of motor weakness. Sensory symptoms are more common among females than males in those participants with many years of experience than in those with few years of work experience. Drinking alcohol was also a risk for developing sensory symptoms.

Unlike other studies, this study showed that handedness, smoking, age, and educational status had no significant association with developing CTS or both sensory and functional symptoms.

Recommendation

Since this study was done in the worksite, it did not include serious cases in which workers were unable to weave owing to severe CTS. As a result, further community-based studies should be conducted. Health education should be given for manual weavers

to take at least two breaks per day and to avoid drinking alcohol. It is better to conduct a periodic screening regularly to diagnose CTS early and to minimize functional disabilities.

List of abbreviations
AOR: Adjusted odds ratio, BMI: Body mass index, CTS: carpal tunnel syndrome, COR: Crude odds ratio, DM: Diabetic Mellitus, IQR: interquartile range. ODK: open data kit, RA: Rheumatoid arthritis, SPSS: statistical package for social science, SSS: symptom severity scaling, FSS: functional severity scaling.

Consent for publication
Not applicable

Availability of data and materials
The data sets generated and /or analyzed during the current study are not publicly available due to preserving participant anonymity but are available from the corresponding author on reasonable request.

Competing interests
All authors assert that they have no competing interests.

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Authors' contributions
Hailemariam. Z designed the study, was involved in supervising data collection, analysis, and interpretation of the result, and drafted the paper, and participated in preparing all versions of the manuscript. Mekbeb. A, Biruk. L, Elsa. D and Solomon. M assisted in the design and the proposal development, monitored data collection, assisted during analysis, and revised subsequent drafts of the paper. All authors read and approved the final manuscript.

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