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The Relationship of Work and The Symptom of Carpal Tunnel Syndrome (CTS) in Rujak Sellers in Glenmore District Banyuwangi Regency

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Abstract

Carpal Tunnel Syndrome (CTS) is a neuromuscular disease characterized by tingling, pain and sensory disturbances in the palms and fingers due to compression of the median nerve which is in the carpal tunnel. One of the risk factors for CTS is that repetaed wrist flexion-extension movements over a long period of time can trigger mechanical trauma or ischemia to the median nerve. Rujak (Indonesian traditional salad) seller is one of the jobs that is at risk of experiencing CTS. This research was conducted to determine the relationship between duration and frequency of work and symptoms and severity of CTS in rujak sellers in Glenmore District, Banyuwangi Regency. This cross-sectional analytical observational study was conducted from April to June 2024 and involved 59 respondents. Data was collected through interviews using questionnaires on work duration, work frequency, CTS symptoms and the Indonesian version of the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ). The results of the Spearman analysis show a significant relationship between work duration and CTS symptoms (p=0.005) with a moderate correlation coefficient of 0.361. The results of data analysis also show a significant relationship between work frequency and CTS symptoms (p=0.000) with a strong correlation coefficient of 0.595. This research concluded that the duration and frequency of work had a significant positive relationship with the symptoms and severity of CTS. The longer the duration of work and the more frequent the frequency of work, it can increase the risk of CTS and increase the severity of CTS.

Keywords*: Carpal Tunnel Syndrome; CTS Symptoms; Duration of Work; Frequency of Work*

Introduction

Carpal Tunnel Syndrome (CTS) is one of the most common neuromuscular disorders worldwide. CTS occurs due to median nerve compression in the carpal tunnel area, causing disturbances in median nerve conduction. CTS is characterized by pain, burning, numbness, and tingling in the wrist to the palm of the hand (Sevy & Varacallo, 2023). Epidemiological study shows that the prevalence of CTS globally reaches 50 patients per 1000 population with an incidence rate of 1 to 3 patients per 1000 population each year (Joshi et al., 2022). The prevalence of CTS in Indonesia remains unknown, but a study shows that the incidence of CTS in housewives who often grind spices reaches 61.8% of 838 respondents (Rahman et al., 2022).

CTS can progressively worsen to the point of causing permanent median nerve disorders, especially in the working population who perform continuous wrist flexion-extension movements (Sevy & Varacallo, 2023). Other factors that affect CTS are the duration and frequency of repetitive wrist movements. Study results show that work with active hand movements such as typing, with a duration more than 4 hours and a frequency more than 3 days per week can cause numbness and tingling in the hand area (Mesia et al., 2022). One of the jobs at risk of CTS is a rujak seller. Rujak is a traditional Indonesian fruit and vegetable salad often served with a spicy peanut or palm sugar sauce, requires repetitive movements such as wrist flexion and extension when grinding or preparing the sambal using a mortar and pestle. These repetitive wrist movements, combined with forceful exertions, can increase the risk of developing CTS due to strain on the median nerve as it passes through the carpal tunnel in the wrist. Work with repetitive wrist flexion-extension movements can cause mechanical and ischemic trauma to the median nerve, causing CTS symptoms such as pain, burning, numbness, and tingling in the wrist area to the palm of the hand

(Genova et al., 2020).

Research regarding risk factors of work duration on CTS symptoms in specific high-risk populations such as rujak sellers has not been studied. Glenmore District, Banyuwangi Regency is an area with a typical food, rujak soto, so that the majority works as rujak soto seller. This population is at high risk of experiencing CTS due to repetitive wrist movements while grinding rujak. Therefore, research is needed to define the relationship between work duration and CTS symptoms in rujak sellers in Glenmore District, Banyuwangi Regency which can be the basis for education and prevention of CTS incidents.

Methods

Research design
The research design used was analytical observational with a cross-sectional approach.

Study subjects
The subjects used in this research were rujak sellers in Glenmore District, Banyuwangi Regency.

Sample size determination
The sample size was determined using the Lameshow formula.

$$n = \frac{Z^2_{1-\alpha/2}\, p\,(1-p)\, N}{d^2(N-1) + Z^2_{1-\alpha/2}\, p\,(1-p)}$$

Explanation:
n = Minimum sample size required
$Z_{1-\alpha/2}$ = 1,96 (corresponds to a 95% confidence level)
P = proportion (based on a previous study, 0.618)
N = total population (70)
d = margin of error (set at 5% or 0.05)

Based on the calculation results, the minimum sample size required for this study is 59 rujak sellers. Sampling using the quota sampling technique. This sampling technique is being used to ensure that the selected respondents meet specific criteria relevant to the study, such as being rujak *sellers and having certain work characteristics (e.g., duration and frequency of work). By using a quota sampling technique, the study aims to achieve representation of the population within predefined categories, ensuring the data collected is aligned with the study objectives despite potential resource limitations.*

Measurements

Research carried out from April to June 2024. Interview respondents regarding duration of work, frequency of work and symptoms of Carpal Tunnel Syndrome (CTS). Symptoms evaluated included pain, tingling, numbness, burning sensation, weakness, or electric shock-like sensations in the wrist, palm, thumb, and up to the middle of the ring finger. The severity of CTS was assessed using the Indonesian version of the Boston Carpal Tunnel Questionnaire (BCTQ) which had been validated by Octaviani et al, 2022.

Statistical analysis

The software used for analysis is IBM SPSS Statistics 26.0, which is to carry out the Spearman correlation test.

Ethical clearance

The ethics committee of the Faculty of Medicine, University of Jember has reviewed this research and declared it ethically appropriate according to ethical clearance No. 1555/UN25.1.10.2/KE.2024.

Results

Sociodemographic characteristics of the respondents presented in Table 1. The data shows that the average age of the sample is 48.94 years, more in the 50-59 age group (39%), and all respondents are women. Majority of the respondents work every day (42.4%) with duration of 1 to 2 hours per day (49.2%). The results of the interview using questionnaire showed that 41 respondents (69.5%) had CTS symptoms, while 28 respondents (28%) were categorized as having mild symptoms based on measurement of the severity of CTS using *Boston Carpal Tunnel Questionnaire* (BCTQ).

Table 2 shows the distribution of samples based on the duration and frequency of work against CTS symptoms. Respondents that work 1-2 hours per day and more than 2 hours per day tend to have CTS symptoms, specifically 24 respondents that work 1-2 hours per day, and 12 respondents that work more than 2 hours per day. This is also found in the frequency of work, respondents that work 4-5 days per week and every day tend to have CTS symptoms, 15 respondents and 24 respondents respectively. This study found that the longer and more often the rujak sellers worked, the more they showed CTS symptoms.

The distribution of sample based on duration and frequency of work against the severity of CTS is shown in Table 3. Respondents with working duration less than 1 hours per day mostly had no CTS symptoms, which were 8 out of 15 respondents, while respondents with working duration 1-2 hours and more than 2 hours per day mostly had mild-moderate based on CTS severity, 27 and 14 respondents, respectively. These results were also obtained on the frequency of work, respondents who work only 1-3 days per week mostly had no CTS symptoms, which were 6 out of 11 respondents, while respondents who work 4-5 days per week and every day had mild-moderate CTS symptoms, 20 and 23 respondents, respectively.

Results of bivariate analysis of the Spearman correlation test regarding duration of work, frequency of work and CTS symptoms can be seen in Table 4. The data shows a significant relationship between duration of work and CTS symptoms (p-value 0.005) with a correlation coefficient of 0.361, there is a strong positive relationship (0.26 – 0.50). Results of data analysis also show a significant relationship between frequency of work and CTS symptoms (p-value 0.000) with a correlation coefficient of 0.595, there is a strong positive relationship (0.51-0.75).

Results regarding duration of work, frequency of work, and severity of CTS based on BCTQ are presented in Table 5. Results of data analysis show a significant relationship between duration of work and CTS severity (p value 0.000) with a correlation coefficient of 0.495, there is quite positive relationship (0.26 – 0.50). Results of data analysis also show

a significant relationship between frequency of work and CTS severity (p-value 0.000) with a correlation coefficient of 0.691, there is a strong positive relationship (0.51-0.75).

Table 1. Sociodemographic characteristics of the Respondents

Characteristics	Result (n)	Percentage (%)
Average age (years)	48,94	-
17-29 years	0	0
30-39 years	9	15,3
40-49 years	21	35,6
50-59 years	23	39
>60 years	6	10,1
Sex		
Male	0	0
Female	59	100
Duration of Work		
<1 hour/day	15	25,4
1-2 hours/day	29	49,2
>2 hours/day	15	25,4
Frequency of work		
1-3 days/week	11	18,6
4-5 days/week	23	39
Everyday	25	42,4
CTS Symptoms		
No	18	30,5
Yes	41	69,5
CTS Severity Level based on BCTQ		
Normal	9	15,3
Slight	28	47,5
Medium	20	33,9
Severe	2	3,4
Very Serious	0	0

Table 2. The distribution of samples based on the duration and frequency of work against CTS symptoms

		CTS Symptoms		Total (n)
		No	Yes	
Duration of Work	**< 1 hour/day**	10	5	15
	1-2 hours/day	5	24	29
	>2 hours/day	3	12	15
Frequency of Work	**1-3 days/week**	9	2	11
	4-5 days/week	8	15	23
	Everyday	1	24	25
Total		18	41	59

Table 3. The distribution of sample based on duration and frequency of work against the severity of CTS

		CTS Severity Level based on BCTQ				Total (n)
		Normal	Slight	Medium	Severe	
Duration of Work	**< 1 hour/day**	8	5	2	0	15
	1-2 hours/day	1	17	10	1	29
	>2 hours/day	0	6	8	1	15
Frequency of Work	**1-3 days/week**	6	5	0	0	11
	4-5 days/week	3	16	4	0	23
	Everyday	0	7	16	2	25
Total		9	28	20	2	59

Table 4. Correlation of duration of work, frequency of work and CTS symptoms

	CTS Symptoms	
	P value	*Correlation Coefficient*
Duration of Work	0,005*	0,361
Frequency of Work	0,000*	0,595

*Significant at the alpha value 0,005

Table 5. Correlation of duration of work, frequency of work, and severity of CTS based on BCTQ

	CTS Symptoms	
	P value	*Correlation Coefficient*
Duration of Work	0,000*	0,495
Frequency of Work	0,000*	0,691

*Significant at the alpha value 0,005

Discussion

This study data shows that the average age of sample is 48.94 years old, with a predominantly of the age group of 50-59 years. Carpal Tunnel Syndrome often occurs in aged 40 to 60 years (Putri, 2019). This age effect is alleged to be related to the effects of the aging process or the length of exposure, resulting in synovial thickening due to repeated stretching and pulling of the wrist, which can increase pressure in the carpal tunnel (Triana et al., 2020). The severity of CTS in men increases with age, while in women CTS occurs after menopause, due to hormonal changes in women which can increase the risk of CTS (Kasatria Putra et al., 2021). This explains why in this study CTS occurred in the 50-59 years age group, which is the age after menopause in women.

In this study, all the rujak sellers in Glenmore District, Banyuwangi Regency were female, in contrast to other studies about the incidence of CTS in other jobs or professions. Research by Lisay et al. (2016) who studied CTS in typists obtained ratio 1:2 comparison of female and male samples. Another study by Kasatria Putra et al. (2021) that assessed CTS in editing computer workers also obtained 62.7% of the study sample being male. On the other hand, according to the theory, the incidence of CTS is more common in female, with the ratio of female to male 3-5:1 (Putri, 2019). Female in grades had a 3.6 times greater risk of CTS severity than male (Kasatria Putra et al., 2021). This is due to anatomical differences where the carpal bone in females is smaller, creating a tighter space where the nerves and tendons must be straight (Ken Risky Lisay et al., 2016). Researchers conclude that this research is all female because the culture of grind sambal in rujak is generally the ability of female, not male.

This study was found that there was a relationship between the duration and frequency of work on CTS symptoms in rujak sellers in Glenmore District, Banyuwangi Regency. Most respondents who had CTS symptoms generally worked with a duration of 1-2 hours per day, and at least 3-5 days during the week. This result is consistent with the previous study by Bibi and Khan (2019) which showed a positive relationship between CTS and the working duration of keyboard and mouse use, with duration of work more than 20 hours per week. This research is also similar to the research by Rahardjo et al. (2021) which shows a correlation between the duration of work and the incidence of CTS in administrative officers at RSUD Dr. Soetomo Surabaya, where CTS symptoms appear in workers who have worked more than 4000 hours in 3-4 years on 276 effective working days a year (3-5 hours a day).

The gold standard for diagnosing Carpal Tunnel Syndrome (CTS) is electrodiagnostic testing, specifically electromyography and nerve conduction velocity (EMG-NCV) studies. EMG-NCV evaluates the median nerve's conduction velocity and latency, providing objective data on nerve dysfunction. These tests can confirm CTS, assess the severity of nerve compression, and exclude other neuropathies or conditions that may mimic CTS symptoms. Although questionnaires such as the Boston Carpal Tunnel Questionnaire (BCTQ) that valuable in assessing symptoms and functional status, they cannot replace EMG-NCV as the definitive diagnostic tool. These questionnaires are based on subjective patient-reported outcomes and are susceptible to individual interpretation and bias. While questionnaires provide useful initial information for identifying potential CTS cases, they lack the precision and objectivity required to confirm the diagnosis. Therefore, for accurate diagnosis, EMG-NCV remains essential, especially in cases where surgical intervention is being considered (Padua et al., 2016).

In clinical practice, questionnaires are primarily used for screening purposes to identify patients who are likely to have CTS and who may benefit from further evaluation with EMG-NCV. Research has shown a correlation between questionnaire results and clinical findings, but this correlation is moderate at best. For example, the Boston Carpal Tunnel Questionnaire has demonstrated a positive correlation with physical examination findings and EMG-NCV results, but it cannot independently establish the diagnosis. These tools are useful in triaging patients and identifying those who may require further diagnostic testing. Future research should investigate the diagnostic accuracy and reliability of commonly used physical examination techniques such as Phalen's test, Tinel's sign, and carpal compression tests. Comparative studies that evaluate the sensitivity and specificity of these physical tests alongside EMG-NCV could help refine clinical diagnostic pathways. Additionally, exploring the combined use of physical examination findings, questionnaires, and EMG-NCV may lead to the development of comprehensive diagnostic algorithms for CTS.

The duration and frequency of work per day are risk factors for CTS symptoms, especially in jobs that require repetitive movements of the wrist, such as rujak sellers. Rujak sellers often make repeated wrist flexion-extension movements when grind sambalinding. This movement can cause mechanical trauma, increased pressure, and ischemic damage within carpal tunnel structures, including the median nerve. CTS symptoms such as pain, burning, numbness and tingling in the wrist area to the palms caused by compression of the median nerve.

The American Compensation Corporation in 2014 has classified several factors that can increase the risk of CTS in a worker, which were: work that requires high grip strength, strong and repetitive wrist movements, lack of rest time of at least 15% of daily work time. , flexion or extension of the wrist more than 2/3 of working hours per day, and using vibrating work tools (ACC, 2014). Research by Setiawati et al. (2016) that assessed repetitive movements in female brick press workers found that

96.2% of workers who had CTS symptoms performed ≥30 repetitive movements per minute.

This study found that most of the samples had CTS symptoms at work duration of 1-2 hours per day, shorter than other studies. Researchers suspect this is related to the frequency of movements per minute and the pressure required is generally greater in rujak sellers compared to other jobs. In addition, a trader or entrepreneur have more flexible time of work than other jobs, so this will affect the frequency of work per week and affect the incidence of CTS. Duration and frequency of work are factors that are interconnected with each other and cannot be separated in determining the incidence of CTS in workers. Because the activity of grind sambal is important in terms of the texture and taste of food for rujak sellers, there will be challenges in providing education regarding CTS prevention to rujak sellers.

This study also assessed how the duration and frequency of work affected the severity of CTS based on the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ). This research found that there is a relationship between duration and frequency of work on the severity of CTS in rujak sellers in Glenmore District, Banyuwangi Regency. The longer and more often the rujak seller works, the more severe the severity of CTS. This research is in accordance with the research of Al-Jasim et al. (2023) on banking workers who use devices for work, which found a relationship between the duration of device use and the severity of CTS based on BCTQ. Research by Matur et al. (2023) regarding CTS in dentists also found that there was a relationship between the duration of weekly hand use and the severity of CTS based on BCTQ.

The severity of CTS will increase if repetitive movements are performed more frequently. Long work duration and frequent work frequency will make repetitive movements take longer to be carried out, so that blood flow in the carpal tunnel vessels decrease. Over time, the flow of blood capillary circulation will be affected and will have an impact on the permeability of the blood vessels in the wrist, which are the radial and ulnar arteries. This will cause nutritional disorders and stress on the median nerve and aggravate CTS symptoms (Amalia et al., 2023; Hamid et al., 2020; Setyowati et al., 2015).

While the specific topic of rujak sellers has not yet been extensively studied, a study by Nimas et al. (2016) titled "Hubungan antara mengulek dengan kejadian carpal tunnel syndrome pada penjual gado-gado" investigated the relationship between the repetitive task grinding ingredients and the occurrence of CTS in gado-gado sellers. This study highlighted those repetitive motions involving wrist flexion and extension, particularly when performed over long durations without adequate rest, significantly increase the risk of CTS. Such activities exert prolonged pressure on the median nerve within the carpal tunnel, leading to inflammation, swelling, and nerve compression (Nimas, 2016). These findings are relevant to the present study, as rujak sellers engage in similar repetitive tasks, such as grinding ingredients, which may predispose them to CTS. Drawing parallels between these studies emphasizes the broader occupational risk factors for CTS in professions involving high-frequency, repetitive manual tasks.

In contrast to the research of Farahdhiya et al. (2020) in violinists, there was no relationship between playing duration and playing frequency and the incidence of CTS in violinists, but there was a relationship between repetitive movements and the incidence of CTS in violinists. This relationship was not found because the violinists did not always play the violin for the duration of the play. They take breaks to stretch their arms, relax their muscles, or do other activities such as drinking and taking something. In addition, playing the violin does not require a large amount of energy that rests on the wrist. Based on interview, symptoms usually occurs due to a lack of warm-up and adequate rest, especially when playing for more than ten hours (Farahdhiya et al., 2020). This is different from rujak sellers, which requires strength and repetitive movements to grind sambal, even for a short duration.

Conclusion

This research data shows that the duration and frequency of repetitive work over a long period have a significant positive relationship with the symptoms and severity of CTS. The longer the duration of work and the more frequent the frequency of work can increase the risk of CTS symptoms and the severity of CTS.

Conflict of Interest

The author declares that there is no conflict of interest.

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Author contribution

Authors 1 and 2 are involved in the selection of the research idea, conducting the research, processing the data and results, as well as contributing to the preparation of the research manuscript. Author 3 provides input to authors 1 and 2 during the research process, as well as in data processing and report writing phases of the research results.

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