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Original Article

The association between repetitive movement and carpal tunnel syndrome symptoms in meat cutters at Bimoku Kupang slaughterhouse

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ABSTRACT

Background: Carpal tunnel syndrome (CTS) is a common work-related problem, especially in workers with repetitive movements. Workers at Bimoku Kupang slaughterhouse have a high risk for CTS due to movement frequency, such as holding a knife and cutting meat. **Aim:** This study aims to analyze the association between repetitive and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse. **Methods:** This is a cross-sectional observational analytical study performed at Bimoku Kupang slaughterhouse from July to August 2025. A total of 38 respondents were chosen with a total sampling technique. Repetitive movement frequency was measured using the assessment of repetitive tasks tool; meanwhile, CTS symptoms were evaluated using the Boston carpal tunnel questionnaire. Data were analyzed using the Spearman Rank correlation test with significancy $P < 0.05$. **Results:** Most respondents (73.7%) had a high risk for repetitive movement and 52.6% had moderate CTS symptoms, while 47.4% had mild to no symptoms. Correlation test showed a strong positive association and a significant between repetitive movement and CTS symptoms ($r = 0.627$, $P < 0.001$). **Conclusion:** There was a strong and significant association between repetitive wrist movement and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse.

Keywords: Carpal tunnel syndrome, ergonomics, meat cutters, repetitive movement, work error

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INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common musculoskeletal disorders due to occupation, caused by repeated movement of the wrist and causing an increase in pressure on the median nerve. This condition led to symptoms including tingling, pain, and muscle weakness that would interfere with hand function.[1] Globally, approximately one out of seven people had CTS, especially workers performing repeated manual activity.[2]

In Indonesia, CTS has become a major occupational health problem in heavy physical activity sectors, such as slaughterhouse, which involve continuous flexion and extension of the wrist.[3] Workers at the Bimoku Kupang slaughterhouse perform several repeated movements during cutting meat, such as slicing, pulling, and separating meat from bones. These activities increase the risk of pressure on the median nerve, which can trigger CTS symptoms.

However, study about the association between repetitive movement and CTS in slaughterhouse workers in Indonesia is still limited. Therefore, this study aimed to analyze the association between repetitive movement and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse.

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TOOLS AND METHODS

This is an analytical observational study with a cross-sectional design aimed to determine the association between repetitive movement and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse. This study was done from July to August 2025.

Population and Sample

The population of this study included all meat cutters at the Bimoku Kupang slaughterhouse. Total sampling method was performed, therefore, all workers fulfilling the inclusion criteria were asked to become respondents, with a total of 38 people.

Inclusion Criteria

- Aged 18–60 years
- Having worked for 6 months
- Performing meat-cutting activities with repetitive movement
- Consented to become respondent and signed informed consent form.

Exclusion Criteria

- History of osteoarthritis, hyperuricemia, or nerve damage
- History of trauma on the wrists (fracture, sprain, or dislocation)
- Mass at the wrists (ganglion cyst or lipoma).

Study Variable

In this study, independent variable is repetitive movement. Dependent variable is CTS which was assessed based on the severity of sensory and motoric complaints of the hand. Moreover, this study also considered several confounding variables which may potentially affect the relation between two main variables, which were work duration, work posture, and specific health issues which may influence wrist and median nerve functions.

Ethical Consideration

Ethical approval was obtained from Ethics Committee of the Faculty of Medicine Universitas Nusa Cendana (No: 26.1/UN15.21/KEPK-FKKH/2025). All respondents gave written informed consent before data collection was performed.

Operational Definition and Instruments

Repetitive movement

Evaluated using the assessment of repetitive task (ART) tool, which assesses movement frequency, strength, posture, and work duration. Movement frequency categorized as:

- Low risk: ≤10 movements per minute
- Moderate risk: 11–20 movements per minute
- High risk: >20 movements per minute.

CTS symptoms

It assessed using Boston carpal tunnel questionnaire (BCTQ) which evaluates symptom severity scale (SSS).

Score category

- Mild: 1.0–2.0
- Moderate: 2.1–3.4
- Severe: ≥3.5.

Data collection procedure

Repetitive movement was evaluated through researcher's direct observation using stopwatch and ART tool guidance. A structured interview was conducted using the BCTQ questionnaire to assess the severity of symptoms and functional impairment of the hand.

Data analysis

Univariate analysis was used to describe respondent's characteristics distribution, the level of repetitive movement, and CTS symptom category. Normality test using Kolmogorov–Smirnov and Shapiro–Wilk showed that the data were not normally distributed. Due to this, analysis of the association between repetitive movement and CTS symptom was performed using the Spearman rank correlation test with significancy $P < 0.05$.

RESULTS AND DISCUSSION

Results

Table 1 shows that all respondents in this study were male (100%). Most respondents were aged 18–40 years (55.3%), while 44.7% were aged 41–60 years, indicating that the majority of workers were of productive age. Regarding work duration, most respondents had worked for more than 5 years (76.3%), while 23.7% had worked for 1–5 years, and none had worked for less than 1 year. On work duration, the majority of respondents had worked for more than 5 years (76.3%), while 23.7% had 1–5 years, and no respondents with work duration <1 year.

Table 2 shows the risk of repetitive movement in the workers, where almost all respondents were on high-risk category.

Table 1: Respondent characteristics

Variable	Frequency (*n*=38)	Percentage
Gender		
Man	38	100
Woman	0	0
Age		
18–40 years	21	55.3
41–60 years	17	44.7
Length of employment		
<1 year	0	0
1–5 years	9	23.7
>5 years	29	76.3

Table 2: Distribution of respondents based on repetitive movements

Repetitive movement	Frequency (*n*=38)	Percentage
Not at risk	1	2.6
At risk	9	23.7
High risk	28	73.7
Total	38	100

Approximately 73.7% workers performed more than 20 movements per minute, which was categorized as high risk. Others were categorized as moderate risk (23.7%), while only 2.6% were grouped as no risk.

Table 3 shows the distribution of CTS symptoms, where 52.6% of respondents had moderate CTS symptoms. Meanwhile, 47.4% had mild or no significant symptoms, and no cases of severe CTS were observed.

Table 4 presents Spearman correlation test results showing a strong and significant correlation between repetitive movement and CTS symptoms. Correlation coefficient r = 0.627 with $P < 0.001$ indicates that the higher the frequency of repetitive movement, the more severe CTS symptoms reported.

Discussion

The study result showed a strong and significant positive association between repetitive movement and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse, with a Spearman correlation coefficient of 0.627 and $P < 0.001$. This indicated that the higher the level of repetitive movement on the wrist, the more severe CTS symptoms reported.

This finding is consistent with the pathophysiology of CTS, in which repeated wrist flexion and extension increase intracarpal pressure, causing inflammation of the synovial tissue, resulting in intraneural edema and eventually leading to median nerve compression. The mechanism has been explained in neurology and work biomechanic literature and was similar with global study showing an increase risk of CTS in workers repeated movement exposure.[4]

The majority of the workers in this study were placed in high-risk category (73.7%); however, reported CTS symptoms were mostly mild to moderate level, without severe cases. This condition may be affected by several protective factors, such as motoric adaptation to experienced workers, the use of knives that are regularly sharpened to reduce excessive grip force, and the presence of microbreaks which helped decrease the accumulation of mechanical stress. Specific work techniques, like maintaining a more neutral wrist angle, also influenced in reducing the pressure on the carpal tunnel.[5]

Table 3: Distribution of respondents based on carpal tunnel syndrome symptoms

CTS symptoms	Frequency (*n*=38)	Percentage
Mild or no symptoms	18	47.4
Moderate symptoms	20	52.6
Severe or very severe symptoms	0	0
Total	38	100

CTS: Carpal tunnel syndrome

Table 4: Relationship between repetitive movements and carpal tunnel syndrome symptoms

Variable	Spearman's r	*P*-value	Interpretation
Repetitive movements - CTS symptoms	0.627	<0.001	Strong, significant correlation

r=Spearman correlation coefficient. *P* value is considered significant if <0.05. CTS: Carpal tunnel syndrome

Meat cutters especially combined wrist flexion, extension, radial deviation, and ulnar deviation movements which were performed intensively, often more than 20 times/min. Based on Health and Safety Executive guidance, this frequency was categorized as high risk to musculoskeletal disorders, especially if performed on non-neutral posture.[6] This result is similar with a study from Triana D, 2020 which stated that workers with repetitive movement exposure had a 10-time higher risk to had CTS.[7] A study from Dharmaputra I, 2017 also reported an increase of risk up to 8 times in group with high repetitive.[8] The result from this study supported both studies, especially due to the characteristic of meat cutters which demand long work duration and repeated movement pattern.

Overall, significant relation between repetitive movement and CTS symptom in this study affirmed the importance of ergonomic factor on occupations demanding intensive wrist movement. The implementation of prevention strategy, such as shift rotation, work rhythm arrangements that enable microbreaks, the use of ergonomic tools, and work technique education has become a crucial step to prevent CTS progressivity, increase safety, and maintain productivity of meat cutters.

CONCLUSION

Statistical result showed a significant and strong relation between repetitive movement and CTS symptoms in meat cutters at Bimoku Kupang slaughterhouse. The higher the frequency of repetitive movement, the more severe CTS symptoms reported by the respondents.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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