

# Risk Factors of Carpal Tunnel Syndrome among Food-Packing Workers in Karanganyar

## Faktor Risiko *Carpal Tunnel Syndrome* pada Pekerja Pengepakan Makanan di Karanganyar

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### Abstract

Carpal Tunnel Syndrome occurs when the median nerve, which runs from the forearm into the hand, suffers pressure or is squeezed in the wrist. The results may be pain, weakness, or numbness in the hand and wrist, radiating up to the arm. This study aimed to examine the risk factors i.e age, sex, work period and repetitive movements toward Carpal Tunnel Syndrome complaints among food-packing workers in Karanganyar. The study was conducted in October to December 2014 that used analytic observational design with cross sectional study. Samples were 50 of 67 food-packing workers in Jaten Karanganyar industrial area as taken by using simple random sampling technique. Data were analyzed using chi square and multivariate logistic regression. Results showed that age and sex had significant relation with Carpal Tunnel Syndrome and age was the most influential factor 24 times to increased risk of Carpal Tunnel Syndrome (p value = 0.057, Exp.  $\beta$  = 24.965).

**Keywords:** Age, carpal tunnel syndrome, food-packing workers, repetitive movement, sex

### Abstrak

*Carpal Tunnel Syndrome* terjadi ketika saraf median, yang membentang dari lengan bawah ke tangan, mengalami tekanan atau terpuntir di pergelangan tangan. Hasilnya mungkin sakit, kelemahan atau mati rasa di tangan dan pergelangan tangan, yang memancar ke lengan tangan. Penelitian ini bertujuan untuk mengkaji faktor risiko usia, jenis kelamin, masa kerja dan gerakan repetitif terhadap keluhan *Carpal Tunnel Syndrome* pada pekerja pengepakan makanan di Karanganyar. Penelitian ini dilaksanakan pada bulan Oktober – Desember 2014 menggunakan desain observasional analitik dengan penelitian potong lintang. Sampel terdiri dari 50 orang dari total 67 pekerja pengepak makanan di kawasan industri Jaten Karanganyar yang diambil dengan menggunakan teknik *simple random sampling*. Data penelitian diolah menggunakan uji kai kuadrat dan regresi logistik multivariat. Hasil penelitian menunjukkan bahwa usia dan jenis kelamin signifikan berhubungan dengan keluhan *Carpal Tunnel Syndrome*, dan usia merupakan faktor yang paling berpengaruh 24 kali lipat untuk meningkatkan risiko terjadinya *Carpal Tunnel Syndrome* (nilai p = 0.057, Exp.  $\beta$  = 24.965).

**Kata kunci:** Usia, *carpal tunnel syndrome*, pekerja pengepakan makanan, gerakan repetitif, jenis kelamin

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## Introduction

Carpal tunnel syndrome occurs when the median nerve, which runs from the forearm into the hand, suffers pressure or is squeezed in the wrist. The results may be pain, weakness, or numbness in the hand and wrist, radiating up to the arm.<sup>1</sup> Carpal tunnel syndrome is the most common hand problem, affecting as much as 5% of the adult population; yet in most of cases, the condition is idiopathic. While surgical treatment often results in improvement, residual loss of function and some persistence of symptoms are common.<sup>2</sup> Carpal tunnel syndrome is due to extended periods of repetitive forceful work, work involving vibration, extreme postures of the wrist, or a combination of the three.<sup>3</sup> Carpal tunnel syndrome is also caused by factors outside of work, such as sex, age, heredity, hormonal, weight, diabetes mellitus and pregnancy. Musculoskeletal disorders, including carpal tunnel syndrome, represented 59% of all recognized diseases recorded by the European Occupational Diseases Statistics in 2005.<sup>4</sup>

In Jakarta, Indonesia a study in the garment industry found that workers had high prevalence of carpal tunnel syndrome at 20.3%.<sup>5</sup> In the informal sector in Central Java, especially sauces and soy sauce industries in Karanganyar, there are many complaints from the workers about pain, weakness, or numbness in their arms while installing bottle of soy sauce and sauces using a press machine. Risk factors for carpal tunnel syndrome are found in activities that require repetitive hand movements, vibration and forceful gripping which may be present when using a press machine and packing bottle of soy sauce and sauces into boxes. More prolonged and repetitious flexion or extension of the wrist materially, can increase the risk of carpal tunnel syndrome, especially when allied with a forceful grip. The study found reasonable evidence that regular and prolonged use of handheld vibratory tools was associated with a more than double risk of carpal tunnel syndrome.<sup>6</sup> It is the most common form of nerve entrapment syndrome. It can be a debilitating condition with significant socioeconomic costs in the form of reduced productivity, wage reimbursement and compensation claims.<sup>7</sup> This study aimed to determine the most influential factors in the incidence of carpal tunnel syndrome among the food-packing workers at Jaten Karanganyar industrial area including sex, age, work period, and repetitive movement. This study did not include the other factors of carpal tunnel syndrome because most respondents had no records of congenital diseases of carpal tunnel syndrome, had normal weights, and none had diabetes mellitus or were pregnant.

## Method

The study used the analytic observational design with

cross sectional study. Samples were 50 of 67 food-packing workers in Jaten Karanganyar industrial area as taken by using simple random sampling technique. This study aimed to determine the most influential factors in the incidence of carpal tunnel syndrome among food-packing workers in Jaten Karanganyar industrial area. The independent variables in this study were age, sex, work period and repetitive movement, while the dependent variable was carpal tunnel syndrome Symptoms collected with A Self Administrative questionnaire for the Assessment of Severity of Symptoms and Functional Status in carpal tunnel syndrome by DW Levine.<sup>8</sup> In carpal tunnel syndrome symptom questionnaire, Levine *et al.*,<sup>8</sup> identified six critical domains for the evaluation of carpal tunnel syndrome that were pain, test-retest reliability of paraesthesia, numbness, weakness, nocturnal symptoms and overall functional status. Each question had five ordinal severity scale ranging from 0 (none or never) to 4 (very severe).

Data collected from the Levine questionnaire were then processed for further analysis with SPSS 17 Program. Univariate analysis provided the distribution of frequency, while bivariate analysis applied chi square test using  $\alpha = 0.05$  and then multivariate analysis used binomial logistic regression. Binomial logistic regression was the approach to analyze one or more independent variables that had more than two dichotomized values. Variables with a p value less than 0.025 were included in this model.

## Results

This study was conducted in Karanganyar, Indonesia. The respondents in this study were persons working for a food factory and running a pressing machine to close the bottle of soy sauce and sauce. Table 1 showed the characteristics and risk factors of carpal tunnel syndrome and most variables had high risk to exposure of carpal tunnel syndrome symptom such as age, work period and repetitive movement. Table 2 showed that age and sex had significant relation with carpal tunnel syndrome symptom, and the most dominant factor of carpal tunnel

Table 1. Distribution of Respondents Risk Factors of Carpal Tunnel Syndrome

Variable	Category	Frequency	Percentage
Sex	Male	23	46 %
	Female	27	54 %
Age	> 40 years	19	38 %
	≤ 40 years	31	62 %
Work period	≤ 1 year	15	30 %
	> 1 year	35	70 %
Repetitive movement	> 10 movements/minute	14	28 %
	≤ 10 movements/minute	36	72 %
CTS symptom	None	9	18 %
	Mild	27	54 %
	Moderate	14	28 %

Table 2. Bivariate Analysis of Carpal Tunnel Syndrome Using Chi Square Statistical Test

Risk Factors of CTS	CTS Severity Category (N/%)					p Value
	Category	Moderate	Mild	None	Total	
Age	Old > 40 years	11 (57.9%)	7 (38.8%)	1 (5.3%)	19 (100%)	0.001
	Young ≤ 40 years	3 (9.7%)	20 (64.5%)	8 (25.8%)	31 (100%)	
Sex	Male	2 (8.7%)	14 (60.9%)	7 (30.4%)	23 (100%)	0.008
	Female	12 (44.4%)	13 (48.1%)	2 (7.44%)	27 (100%)	
Work period	Old > 1 year	12 (34.2%)	17 (48.7%)	6 (17.1%)	35 (100%)	0.312
	New ≤ 1 year	2 (13.3%)	10 (66.7%)	3 (20%)	15 (100%)	
Repetitive movement	>10 Movements/minute	5 (35.7%)	8 (57.1%)	1 (7.1%)	14 (100%)	0.423
	≤10 Movements/minute	9 (25%)	19 (52.8%)	8 (22.2%)	36 (100%)	

Table 3. Multivariate Analysis Using Multinomial Regression Statistical Test

Variable	$\beta$	p Value	Exp. $\beta$	95% CI
Age	3.217	0.057	24.965	0.908 - 686.393
Sex	-1.806	0.202	0.164	0.010 - 2.625

syndrome symptom was age with significance value of 0.025 with exp B 5.014 (Table 3).

### Discussion

Age of the workers can effect with musculoskeletal disorders symptoms. Muscle strength decrease with age leading to an increased risk of musculoskeletal disorders.<sup>9</sup> Carpal tunnel syndrome has a high prevalence in patients aged between 40 – 50 years. The syndrome develops more easily when there is an increase in the sheath (edema) thickness or in occasions where there is a reduction in the carpal canal's dimensions.<sup>2</sup> The result of bivariate analysis showed significant relation between age and carpal tunnel syndrome (p value = 0.001), and multivariate analysis showed that age was the most dominant factor of carpal tunnel syndrome (significance value = 0.025, Exp. B = 5.014) which means that age accounted for a five fold change in carpal tunnel syndrome prevalence. This could be because the food-packing workers in Karanganyar were mostly older than 40 years (62%) so were in the age category which was to carpal tunnel syndrome. This is in line with a study by Toosi KK,<sup>10</sup> which found a positive correlation between age and carpal tunnel syndrome risk for those in computing jobs.

Female had a higher risk of carpal tunnel syndrome.<sup>11</sup> It might be that the wrist bones are naturally smaller in most women, creating a tighter space through which the nerves and tendons must pass. Women also deal with strong hormonal changes during pregnancy and menopause that make them more likely to suffer from carpal tunnel syndrome.<sup>12</sup> The result of bivariate analysis showed significant relation between sex and carpal tunnel syndrome (p value = 0.008), but did not show the dominant factor in carpal tunnel syndrome with multi-

variate analysis. This result might be because the sample contained a similar number of male (54%) and female (46%) and they were all given the same target in the packing of soy sauce and sauces. These results were not in line with meta analyses showing that sex was the most important predisposing factor related to carpal tunnel syndrome.<sup>13</sup>

Several studies suggested that exposure to low load repetitive tasks could increase the risk factor for carpal tunnel syndrome development, especially with prolonged activity.<sup>14,15</sup> The pressure inside the carpal tunnel increases during wrist extension and flexion. Repetitive extension and flexion movements of the wrist, along with flexion of the fingers and supination of the forearm, have been implicated in this increase risk.<sup>16</sup> The result of bivariate analysis showed no significant relation between repetitive movement and carpal tunnel syndrome (p value = 0.423). These results were inversely with the data of repetitive movement, that mostly food-packing workers performed repetitive movement more than 10 times in one minute (72%). It could be because the food-packing workers had a chance to take a rest when they were tired or fatigued. These results were not in line with a review by Palmer,<sup>17</sup> which examined several cross-sectional studies and six case-control studies on occupational associations with carpal tunnel syndrome. Most investigations analyzed risks by job title and found high prevalence rates and relative risks in several jobs believed to involve repetitive and forceful gripping.

The risk factors associated with carpal tunnel syndrome were present in jobs that involved repeated forced movements of flexion extension of the wrist and fingers with incongruent posture and use of vibrating instruments.<sup>18</sup> The result of bivariate analysis showed no significant relation between work period and carpal tunnel syndrome (p value = 0.312). This result was in line with a study by Tana,<sup>5</sup> that work period did not show a significant relation with carpal tunnel syndrome. In the mining industry, a study showed that 15% of the reported carpal tunnel syndrome prevalence could be accounted for by vibration.<sup>19</sup>

Work period is one of many factors that may increase the risk of musculoskeletal disorders beside repetitive and flexion. In the long term it may cause damage to the median nerve around the hand.<sup>20</sup> Unnatural posture over a long period of time can also cause musculoskeletal disorder.<sup>21</sup> These studies were different with presence of carpal tunnel syndrome in repetitive and flexion jobs with mouse computer. There was a significant relation between the length of employment and carpal tunnel syndrome. Repetitive manual tasks increase mechanical stress on the median nerve and result in elevated carpal tunnel pressure, ischemia, and finally, histological changes of the median nerve and connective tissue within the carpal tunnel.<sup>22</sup>

## Conclusion

Risk factors that have significant relation with carpal tunnel syndrome in food-packing workers in Karanganyar are age and sex. Age of the food-packing workers is the most dominant factor of carpal tunnel syndrome (p value= 0.057, Exp.  $\beta$  = 24.965) which means that age has the opportunity 24 times in carpal tunnel syndrome.

## Recommendation

To reduce the incidence of carpal tunnel syndrome, the company should give job rotation for workers aged older than 40 years and increase the number of male workers to do sauce and soy sauce packing.

## References

- Ganglberger JA, Grunert V, Muller MM, Zaunbauer F. Carpal tunnel syndrome. *Wiener Medizinische Wochenschrift*. 2012;124(33-35): 490-5.
- Luchetti R, Amadio R. Carpal tunnel syndrome. Springer-Verlag Berlin Heidelberg. 2002.
- International Labour Organization. List of occupational disease. Switzerland: International Labour Organization; 2010. p.2
- International Labour Organization. The prevention of occupational disease. Switzerland: International Labour Organization; 2013. p.273-7.
- Tana L, Halim FS, Delima, Ryadina W. Carpal tunnel syndrome pada pekerja garmen di Jakarta. *Buletin Penelitian Kesehatan*. 2004; 32 (2): 73-82.
- Raja S, Carlos AJ. Carpal tunnel syndrome - current controversies. *Orthop Trauma* [Internet]. 2015; 29(4): 273-7. Available from: <http://dx.doi.org/10.1016/j.mporth.2015.08.001>
- Dias JJ, Burke FD, Wildin CJ, Heras-Palou C, Bradley MJ. Carpal tunnel syndrome and work. *Journal Hand Surgery Am* [Internet]. 2004; 29(4): 329-33. Available from: <http://dx.doi.org/10.1016/j.berh.2015.04.026>
- Levine D, Simmons B, Korrs M, Daltroy L, Hohl G, Fossel A, *et al*. A self administratif questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *Classic Papers in Orthopaedics*. Springer-Verlag. 2014; p. 349-51.
- Ulfah N, Harwanti S, Nurcahyo PJ. Sikap kerja dan risiko musculoskeletal disorders pada pekerja laundry. *Kesmas: Jurnal Kesehatan Masyarakat Nasional*. 2014; 8(7): 313-8.
- Toosi KK, Hogaboom NS, Oyster ML, Boninger ML. Computer keyboarding biomechanics and acute changes in median nerve indicative of carpal tunnel syndrome. *Clinical Biomechanics* [Internet]. 2014; 30(6): 546-50. Available from: <http://dx.doi.org/10.1016/j.clinbiomech.2015.04.008>
- Petit A, Ha C, Bodin J, Rigouin P, Descatha A, Brunet R, *et al*. Risk factors for carpal tunnel syndrome related to the work organization: a prospective surveillance study in a large working population. *Applied Ergonomics* [Internet]. 2015; 47(2015): 1-10. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25479968>
- Office on Women Health. Carpal tunnel syndrome [Internet]. U.S. Department of Health and Human Services. 2009. Available from: <http://womenshealth.gov/publications/our-publications/fact-sheet/carpal-tunnel-syndrome.pdf>
- Chammas M. Recent advance carpal tunnel syndrome. *Chir de la Main*. 2014; 33(2): 75-94.
- Ramdan IM, Laksono TB. Determinan keluhan muskuloskeletal pada tenaga kerja wanita. *Kesmas: Jurnal Kesehatan Masyarakat Nasional*. 2012; 7(4): 169-72.
- Schmid AB, Kubler PA, Johnston V, Coppieters MW. A vertical mouse and ergonomic mouse pads alter wrist position but do not reduce carpal tunnel pressure in patients with carpal tunnel syndrome. *Applied Ergonomics* [Internet]. 2015; 47: 151-6. Available from: <http://dx.doi.org/10.1016/j.apergo.2014.08.020>
- Chammas M, Boretto J, Marquardt L, Matta R, Carlos F, Braga J. Carpal tunnel syndrome – part I (anatomy , physiology , etiology and diagnosis). *Revista Brasileira de Ortopedia* [Internet]. 2014; 49(5): 429-36. Available from: <http://dx.doi.org/10.1016/j.rboe.2014.08.001>
- Palmer KT, Medicine O. Carpal tunnel syndrome: the role of occupational factors. *Best Practice Research Clinical Rheumatol*. 2011; 25(1): 15-29.
- Mondelli M, Baldasseroni A, Aretini A, Ginanneschi F, Padua L. Prevalent involvement of thenar motor fibres in vineyard workers with carpal tunnel syndrome. *Clinical Neurophysiology* [Internet]. 2010; 121(8): 1251-5. Available from: <http://dx.doi.org/10.1016/j.clinph.2010.02.150>
- Burke FD, Lawson IJ, McGeoch KL, Miles, Proud GP. Carpal tunnel syndrome in association with hand – arm vibration syndrome: a review of claimants seeking compensation in the Mining Industry. *Journal Hand Surgery British and Europe*. 2005; 30(2): 2005.
- Purwandari C, Agustin M. Work period, work position and carpal syndrome on batik workers. *Kemas*. 2012; 7(2): 170-6.
- Djunaidi Z, Arnur R. Risiko Ergonomi ketidaksesuaian desain dan ukuran tempat duduk sepeda motor terhadap antropometri pada mahasiswa. *Kesmas: Jurnal Kesehatan Masyarakat Nasional*. 2015; 9(3): 243-8.
- Liu C, Chen T, Wang M, Chen C, Lee C. Relationship between carpal tunnel syndrome and wrist angle in computer workers. *Kaohsiung Journal Medicine Science* [Internet]. 2005; 19(12): 617-22. Available from: [http://dx.doi.org/10.1016/S1607-551X\(09\)70515-7](http://dx.doi.org/10.1016/S1607-551X(09)70515-7)