Carpal Tunnel Syndrome Complaints in Female Packing Workers

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**Abstract.** The estimated prevalence of Carpal Tunnel Syndrome (CTS) in the general population is 1–5%. CTS can be experienced by workers who use hand strength in their work. PT. X is one company that still uses manual labor in the process of packing soap and vermicelli. The purpose of this study was to determine the correlation between repetitive movements, wrist posture, age, history of illness, body mass index (BMI), and years of service on complaints of CTS. The research method used a cross sectional study with a sample of 65 workers. Univariate and bivariate data analysis used the chi-square test. Analysis of CTS complaints using a questionnaire and Phalen's test. The results showed that as many as 40 workers (61.5%) experienced complaints of CTS. The results of statistical tests showed that the variable repetitive movement (p = 0.024), age (p = 0.022), BMI (p = 0.031), and years of service (p = 0.024) were associated with complaints of CTS. Workers who experience CTS complaints can be influenced by individual factors and job factors, especially repetitive movements. To prevent severity and relieve complaints of CTS, packing employees can do stretching, massage, independent acupressure massage, and maintain a healthy lifestyle.

# INTRODUCTION

Demands for meeting the economy needs are increasing, making the production activity for goods or services increased. In the production process, human labor is still often used, especially in the packaging and transportation process. However, in the use of human labor, there are limitations in both physical and non-physical abilities which have an impact on the emergence of disorders called musculoskeletal disorders (MSDs). The World Health Organization (WHO) revealed that MSDs are the main cause of disability in the world (World Health Organization, 2019). MSDs are a group of health problems in the function of muscles, tendons and nerves. One example of an MSDs disorder is Carpal Tunnel Syndrome (CTS). CTS is a neuropathic disorder in the form of compression of the carpal tunnel tissue that causes pain in the wrist (Cazares-Manríquez et al., 2020). CTS can cause health problems and cause disability if it is not immediately followed up with medical intervention because it can limit the function of the wrist and it may affect daily activities (Tana, 2003). Research conducted by Bahrudin argues that CTS is influenced by mechanical and vascular factors such as BMI, gender, age, and history of illness (Bahrudin, 2011).

The estimated prevalence of CTS in the general population ranges from 1 - 5% of the general population with an annual incidence of 72 per 100,000, while the prevalence of CTS among workers is 1.7% to 21% of the population (Chaudhry & Gyanchandani, 2020; Dale et al., 2013; Jenkins et al., 2011). CTS is a neuropathy that most often occurs by complaining of several symptoms such as pain, numbness, and tingling in the hands (Inji et al., 2012). From 2007 to 2014, as many as 139,336 cases of workers in California were reported to have suffered from CTS (6.3 cases per 10,000 full-time workers) with a high risk, especially in the clothing industry, food and beverage packaging, as well as administrative work in offices where workers do repetitive movements or maintaining an unergonomic work posture (Jackson et al., 2018).

The National Institute of Occupational Safety and Health (NIOSH) conducted a large systematic review of musculoskeletal disorders in the workplace and CTS is one of them (National Institute of Occupational Health and Safety, 1997). Analysis of data from the 1988 National Health Interview Survey, CTS was the second chronic condition out of 13 work-related cases with 30.7% of cases being experienced by adults (Luckhaupt & Calvert, 2010). This concludes that there is evidence of a positive association between jobs involving repetitive hand movements and the incidence of CTS. However, the prevalence of occupational diseases, especially CTS in work problems in Indonesia, is not yet known. This is because there are still very few, even no occupational diseases, reported either to companies, health facilities or the government.

According to previous research, most of the workers diagnosed with CTS were female workers who had a moderate level of exposure to a moderate working position which was influenced by the two largest factors, namely the frequency of repetitive arm movements and wrist posture (Astrina, 2015; Lazuardi, 2016; Nisa et al., 2018). However, other research states that CTS for men and women does not have a significant difference, especially if the work is done the same (A Çirakli & Ekinci, 2018). That is until a follow-up study was conducted to determine the differences in male and female risk factors for CTS by measuring the cross-sectional area of ​​the carpal tunnel. As a result, the average cross-sectional area of ​​the female carpal tunnel is smaller than that of men (p <0.05). Therefore in theory, this could be a significant factor (Sassi & Giddins, 2016). The occurrence of CTS is characterized by the appearance of sensations such as tingling and numbness, as well as increased weakness in the muscles (Wolny et al., 2019). In addition, years of work is also a risk factor as workers engage in increasingly frequent repetitive movements that can cause compression of the carpal tunnel network.

Work in goods packing is one of the occupations that has the potential for CTS, especially those that still use human labor to perform static repetitive movements. The same study was carried out on workers in the sauce and soy sauce industry in Karanganyar. They installed bottle caps using a press machine with hand power and it was stated that workers often complained of pain, fatigue, and numbness in the arms (Setyawan, 2017).

PT. X is one of the companies that still uses human resources in the packaging of soap and vermicelli. Work is dominated by working position of standing and bending down with monotonous wrist movements that includes outreaching, grasping, and transporting goods. Based on preliminary observations, by doing these movements employees often feel pain and tingling in their wrists. Therefore, further research is needed to determine the correlation between repetitive movements and wrist posture as well as individual characteristics such as age, BMI, medical history, and length of service with complaints of CTS.

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## **METHOD**

This study is an observational analytic study with a cross-sectional study design to determine the correlation between the independent variable (risk factor) and the dependent variable (impact) by measuring and assessing it at one time. The sampling was using a total sample of 65 workers in soap and vermicelli packing activity at PT.X, all of whom are female. Univariate and bivariate data analysis used the chi-square statistical test. CTS complaints in workers were analyzed using a modified Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) questionnaire, conducting a Phalen test to determine the occurrence of complaints carried out for 60 seconds by flexing both palms at an angle of 90° with the help of a physiotherapist, observation sheet RULA assessment, stopwatch, as well as a Mechanical Stadiometer to measure the employee's height and weight.

# RESULT AND DISCUSSION

This research was conducted at PT. X in the packing section which involves repetitive movements of the wrist. Based on the univariate results, there were 40 out of 65 packing workers who experienced CTS complaints (61.5%), 41 workers doing repetitive movements of ≥ 30 actions in one minute (63.1%), 37 workers whose wrist posture was in a high risk level based on the assessment using the RULA method (56.9%), 48 workers aged ≥ 30 years old (73.8%), 16 workers had an abnormal body mass index (24.6%), 20 workers had a history of illness (30.8%) and 41 workers has a work period of ≥ 4 years (63.1%) (Table 1).

**TABLE 1.** Univariate Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Variable** | **n = 65** | **%** | | **CTS complaint**  Yes  Not  **Repetitive Movement**  Yes (≥ 30 actions in 1 minute)  No (<30 actions in 1 minute)  **Wrist Posture**  High Risk  Low Risk  **Age**  ≥30 Years  <30 Years  **BMI**  Abnormal (> 25 or <18 kg / m2)  Normal (18.5 - 25 kg / m2)  **History of Illness**  Has History of Illness  No History of Illness  **Years of service**  ≥ 4 years  <4 Years | 40  25  41  24  37  28  48  17  16  49  20  45  41  24 | 61.5  38.5  63.1  36.9  56.9  43.1  73.8  26.2  24.6  75.4  30.8  69.2  63.1  36.9 |   Source : Primary Data, 2020 |

The bivariate analysis found that the repetitive movement variable (p-value = 0.024), age (p-value = 0.022), BMI (p-value = 0.031), and years of service (p-value = 0.024) were statistically related to CTS complaints. Whereas wrist posture (p-value = 0.373), and history of illness (p-value = 0.510) were not statistically associated with complaints of CTS (Table 2).

**TABLE 2.** Bivariate Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **CTS Complaint** | | | | ***p-value*** | **PR (95% CI)** |
| **Yes** | | **No** | |
| **N** | **%** | **N** | **%** |
| **Repetitive Movement** |  |  |  |  |  |  |
| Yes | 30 | 73.2 | 11 | 26.8 | 0.024 | 3,818  (1,315 - 11,084) |
| Not | 10 | 41.7 | 14 | 58.3 |
| **Wrist Posture** |  |  |  |  |  |  |
| High Risk | 25 | 67.6 | 12 | 32.4 | 0.373 | 1,806  (0.565 - 4,970) |
| Low Risk | 15 | 53.6 | 13 | 46.4 |
| **Age** |  |  |  |  |  |  |
| ≥30 Years | 34 | 70.8 | 14 | 29.2 | 0.022 | 4,452  (1,377 - 14,394) |
| <30 Years | 6 | 35.3 | 11 | 64.7 |
| **BMI** |  |  |  |  |  |  |
| Abnormal | 14 | 87.5 | 2 | 12.5 | 0.031 | 6,192  (1,270 - 30,192) |
| Normal | 26 | 53.1 | 23 | 46.9 |
| **History of Illness** |  |  |  |  |  |  |
| Has History of Illness | 14 | 70.0 | 6 | 30.0 | 0.510 | 1,705  (0.554 - 5,250) |
| No History of Illness | 26 | 57.8 | 19 | 42.2 |
| **Years of service** |  |  |  |  |  |  |
| ≥ 4 years | 30 | 73.2 | 11 | 26.8 | 0.024 | 3,828  (1,315 - 11,084) |
| <4 Years | 10 | 41.7 | 14 | 58.3 |

The results showed that as many as 40 employees (61.5%) complained of tingling and pain in the wrists after conducting the Phalen test and interview for symptoms using the BCTQ questionnaire. This result is in accordance with The National Institute for Occupational Safety and Health (NIOSH), which found that 42% of employees who work in the production section experience CTS characterized by decreased nerve conductivity and the onset of symptoms (Musolin et al., 2014). Symptoms and signs of CTS are caused by compression (pressure) on the median nerve in the carpal tunnel (Chaudhry & Gyanchandani, 2020). Symptoms of CTS include paraesthesia (tingling), numbness, and pain in the hands which are also caused by temporary ischemia of the compressed median nerve (Zamborsky et al., 2017). The American Physical Therapy Association (APTA) recommends that to prevent and relieve the symptoms of CTS, a series of stretching on ​​the muscles of the wrists, hands, and arms can be done by doing 11 basic stretching movements that can be done in a sitting or standing position (American Physical Therapy Association, 1996).

Repetitive movements are movements in work activities that are carried out repeatedly. As many as 73.2% of the packing employees at PT. X who performs repetitive movements has complaints of CTS. Determination of repetitive motion assessment of the wrist is carried out based on the most risky limb used in packing activity which is the right hand. The results of this study indicate that there is a statistical correlation between repetitive movements and complaints of CTS in packing workers (p-value = 0.024). These repetitive movements include movements of outreaching, packaging, and transporting goods to the collection point. From the results of observations and calculations using a stopwatch, it was found that the total frequency of repetitive motion actions performed by packing employees was 25 to 47 times per minute with an average number of actions above 10 times.

This study is in line with the research of Farahdhiya et al., That there is a correlation between the repetitive movement of the right hand and the incidence of CTS in the orchestral chamberstring violis (p-value = 0.009) (Farahdhiya et al., 2020). In theory, rapid repetitive movements involving wrist joint performed every day at work more than 30 times a minute can cause tendinitis (inflammation of the tendons) that results in compression of the nerves, affecting the blood supply to the hands and wrists (Kilbom, 1994; Mallapiang & Wahyudi, 2014; Rambe, 2004). Repetitive movements for over a long period of time can also cause stress to the network around the carpal tunnel which causes the carpal tunnel to become narrow (Setyowati et al., 2015)

Work posture is a very important element in work activities because it can affect the concentration and productivity of workers. Wrist posture is one of the ergonomic problems in the workplace that can cause inflammation and swelling of muscle tissue, nerves, or both to press the median nerve in the wrist (Selviyati et al., 2016). As many as 67.6% of packing employees have a high risk level and experience complaints of CTS. The results of this study indicate that there is no statistical correlation between wrist posture and complaints of CTS (p-value = 0.373). Based on the observations and assumptions of researchers, the absence of this correlation is due to the unergonomic wrist posture carried out by the packing employees was not maintained for a long time because they still have to perform various other movements which cause the wrist position to always change. The non-ergonomic posture that is done is when the wrist is in a position of flexion and extension during the activity of packing soap and vermicelli.

This study is in line with Wardana's research that the unergonomic posture carried out by workers is not always related to the incidence of CTS, and also because there is an inconsistency in the data of workers who carry out odd postures but do not experience CTS (p-value = 0.790) (Wardana et al., 2018). However, this is different from Duncan's theory that the extension posture on the wrist causes pressure on the dorsal retinaculum extensor and additional space in the volar carpal ligament on the volar side which pushes the volar carpal ligament out of the carpal bone causing additional pressure in the carpal tunnel, whereas when the wrist is in a flexed posture, the flexor of the retinaculum compresses the flexor of the tendons beyond its radius. This pressure results in additional pressure on the fluid and will affect the movement of the flexor tendons. This movement causes friction (shift) which can affect the median nerve (Duncan et al., 2017).

Age is a number that describes the length of a person's life from birth to the time this research was conducted. Based on observations, employees aged ≥ 30 years experienced more CTS complaints, namely as many as 34 people (70.8%). The results of this study indicate that there is a statistical correlation between age and complaints of CTS (p-value = 0.022). It is in line with Zyluk's research that there is a correlation between age and CTS with the highest number of patients was in the age range of 40 - 65 years (Zyluk & Puchalski, 2013)

Bray's theory states that age is one of the risks that are closely related to CTS because of the reduction in synovial fluid which causes swelling of the joints as a person gets older (Bray, 1985). A person aged ≥ 30 years will also experience degeneration including tissue damage, formation of scar tissue, and a reduction in fluid which causes the stability of bones and muscles to decrease (Ashworth, 2010). In addition, the potential for increased risk of CTS is also associated with axon loss, development of nerve conduction, and blood vessel abnormalities because the older a person is, the more disease complaints are felt, especially those who work in places that require excessive energy (Cindyastira et al., 2014; Komurcu et al., 2014)

BMI is a condition that shows the level of a person's nutritional status by calculating the ratio between body weight and height. The Ministry of Health of the Republic of Indonesia classifies the BMI range into 3, namely underweight (<18 kg / m2), normal (18.5 - 25 kg / m2), and overweight (> 25 kg / m2), while in this study the BMI range was divided into 2 i.e. abnormal BMI is in the range> 25 or <18 kg / m2) and normal BMI is in the range of 18.5 - 25 kg / m2. Based on the results of observations through measurement of height and weight calculated using the formula, it was found that 14 packing employees who had an abnormal BMI (87.5%) had complaints of CTS. The results of this study indicate that there is a statistical correlation between BMI and complaints of CTS (p-value = 0.031). This study is in line with Nadhifah's research that respondents who have abnormal nutritional status tend to have a 5 times greater risk of experiencing CTS (Nadhifah et al., 2018).

The American Obesity Association states that 70% of all CTS sufferers are overweight. Excess body weight (abnormal BMI) was reported as a risk factor for CTS (Shiri et al., 2015). Being overweight can lead to an increase in fluid accumulation in the carpal tunnel network and an increase in fat tissue or hydrostatic pressure throughout the carpal canal which will interfere with nerve function (Ghali & Nicholls, 2011; Shakir Eman A, 2017). A motor and sensory study on 38 obese CTS patients also stated that obesity can cause severity in the carpal tunnel network (Mansoor et al., 2017). Therefore, weight loss can be a therapy for CTS sufferers as well as a preventive measure by maintaining health.

History of illness is a record of a person's experience with certain diseases or illnesses. There were 14 packing employees who had a history of illness and had complaints of CTS (70.0%). The results of this study indicate that there is no statistical correlation between illness history and complaints of CTS (p-value = 1.705). In line with Blue's research, illness history was not associated with CTS symptoms (p-value = 0.461) (Lazuardi, 2016)

A history of illness such as rheumatoid arthritis, diabetes mellitus, and fractures are important risk factors because they can lead to complaints of CTS. Rheumatoid arthritis which causes tingling sensations in the morning, diabetes mellitus which can cause focal demyelination accompanied by axonal damage due to compression in the carpal tunnel, fractures or dislocations due to synovial inflammation and fibrosis in tenosynivitis, fractures of the carpal bones, and thermal injuries to the hands or forearm (Fitriani, 2012; Solmaz et al., 2017).

Years of service is the total working time a person has in a workplace from when they first start working until currently. Packing workers who have years of service of ≥ 4 years and experience CTS are 30 people (73.2%). The results of this study indicate that there is a statistical correlation between years of service and complaints of CTS (p-value = 0.024). This study is in line with the research of Riccò et al., in female workers in visual display units where there is a correlation between years of service and an increased risk of CTS (p-value = 0.019) (Riccò et al., 2016). Agustin's research also states that years of service is associated with the emergence of musculoskeletal disorders, one of which is CTS, especially those that carry out repetitive movements of the wrist continuously for a long period of time (Agustin, 2012).

A person who works in a workplace that is exposed to repetitive movements within ≥ 4 years has a greater proportion of CTS because the increasing number of working years will increase the amount of time to do repetitive activities (Burt et al., 2013; Nafasa et al., 2019; Setyowati et al., 2015). CTS is a musculoskeletal disorder that does not have an immediate impact. Repetition of movements, especially in the hands, can double the risk of CTS, because the longer the working period, the more frequent the worker will be making repetitive movements.

# CONCLUSION

Packing employees at PT. X who experienced CTS complaints included repetitive movements with wrist postures for high risk levels, aged ≥30 years, having an abnormal BMI, having a history of illness, and most of them with workers who has been working ≥ 4 years. The results of the analysis of CTS complaints using a questionnaire and Phalen's test showed that repetitive movements, age, BMI and years of service were related to CTS complaints. Based on the results of this study, to prevent the severity and relieve complaints of CTS, employees are expected to carry out a series of stretching movements on the wrist for 5 minutes every 3-4 times a day, do a massage or small massage on the wrist by opening the narrowed carpal tunnel, perform "acupressure" massage by pressing around 2-3 fingers under the palms of the hands for 30 seconds, as well as providing dissemination about the cultivation of a healthy lifestyle to the workers so that they always maintain ideal weight.

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