

Risk Factors for Cumulative Trauma Disorders (CTDs) Complaints

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Abstract

Background: The interaction of workers and work tools does not always have a good impact; the mismatch of worker anthropometry and work tools impacts work-related diseases. Jobs with repetitive motions, manual lifting, and awkward postures cause complaints of CTDs. These complaints impact decreased productivity and, in the long run, cause permanent disability. This study aims to determine the risk factors for CTDs complaints.

Material and methods: Analytical observational research with a quantitative approach and a cross-sectional design. The population in this study is production workers at an Indonesian spinning and dyeing factory company. The sampling technique used is Total Sampling. The dependent variable is Complaints of CTDs, with the independent variables namely work posture, gender, age, BMI, and years of service. The research instruments used were questionnaires and REBA. Univariable analysis to determine the frequency distribution and bivariable analysis with the chi-square test.

Result: Work posture is at risk of experiencing CTDs complaints as much as 90.9%, female sex as much as 71.2%, old age 87.9%, BMI not at risk 56.1%, years of service ≥ 4 years is 95.5%, and there are very high CTDs complaints 66.7%. There is a relationship between work posture (p value=0.001) and years of service (p value=0.003) with CTD complaints. There was no relationship between gender (p value=0.393), age (p value=0.960), and BMI 0.429) with complaints of CTDs.

Conclusion: Most workers experience complaints of CTDs. The risk factors for CTDs revealed in this study are work posture and length of service.

Keywords: Cumulative Trauma Disorders; Work posture; Risk Factors; BMI; Years of Service

1. Introduction

Modernization of industrial technology has increased productivity and resource management, including human resources. Until now, industrial technology (for example, robotization) still cannot replace the role of humans as the most critical part of the production process. In the end, there is an interaction between technology and humans. The interaction between these production elements poses a risk to the health and safety of workers. For example, health problems occur due to the incompatibility of worker anthropometry with the machine being operated. One of the health risks in the workplace is injury or illness to workers due to ergonomic hazards. If ergonomic hazards are not resolved quickly, they can trigger health problems for workers, including Cumulative Trauma Disorders (CTDs) [1].

CTDs are a disorder of the musculoskeletal system. The International Labor Organization (ILO) in The Prevention of Occupational Diseases program states that Musculoskeletal Disorders (MSDs) are the most common diseases associated with health problems at work in 27 countries in the European Union. In a survey conducted in Great Britain, it was noted that the incidence of musculoskeletal complaints was 41% of the incidence of work-related illnesses, and

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musculoskeletal diseases accounted for 37% of the causes of someone being absent from work. [2]. The prevalence of musculoskeletal complaints in Indonesia based on the results of a doctor's diagnosis is 7.3%; from these results, Aceh occupies the highest position with a percentage of 13.3% and the lowest position is occupied by West Sulawesi with a percentage of 3.2%. The prevalence of MSDs in 2018 based on doctor's diagnosis based on age shows the lowest prevalence at the age of 15-24 years (1.2%) and the highest at age > 75 years (18.9%) [3].

Cumulative Trauma Disorders (CTDs) and Musculoskeletal Disorders (MSDs) have various definitions. MSDs are injuries and problems of the soft tissues (muscles, tendons, joints, and ligaments) and the nervous system. While CTDs are problems with the muscles, ligaments and nerves caused by excessive use of force, fast movements, use of such force, contact with pressure, awkward or extreme postures, vibration, low temperature, and repetitive movements of the musculoskeletal system. The CTDs study conducted on transport workers found that out of 51 workers, 37 (72.5%) experienced moderate CTDs, and 14 (27.5%) experienced severe CTDs. In garment workers in Indonesia, it is known that 39% of workers experience complaints of CTDs [4].

The initial assessment at the study site indicated a high risk of CTDs. The spinning and dyeing section shows that workers often experience complaints in the arms, shoulders, legs and back muscles and often feel tired after working. Workers also feel aches or pains, tingling, numbness, or weakness in parts of the body and often feel tired after work. The number of muscle complaints workers feel it can be an early indication of CTDs due to frequent repetitive work using awkward or extreme body postures and long periods operating machines in a standing position.

2. Material and methods

This type of research is analytic observational with a quantitative approach and a cross-sectional design. The research was conducted at Bandung, Indonesia's spinning and dyeing factory. The population in this study were all production workers at the Indonesian spinning and dyeing factory company, namely 66 workers. The sampling technique in this research design is Total Sampling.

The variables in this study consisted of the dependent variable, namely Complaints of Cumulative Trauma Disorders (CTDs), with the independent variables, namely work posture, gender, age, body mass index (BMI), and years of service. Data collection used a questionnaire to determine age, gender, years of service, and Body Mass Index (BMI), to measure work posture using the Rapid Entire Body Assessment (REBA), and to measure complaints of Cumulative Trauma Disorders (CTDs) consisting of 28 measurement types of complaints with answer options namely 1 (not sick), 2 (slightly sick), 3 (sick), and 4 (very sick).

Data analysis in this study consisted of two types of analysis; for the first one, univariable analysis was carried out to determine the frequency distribution of respondents in each research variable, and then bivariable analysis was carried out with the chi-square test to determine the relationship between the independent variables and the dependent variable.

This research has complied with research ethics principles by providing information for respondents' approval, informed consent, anonymity, and confidentiality.

3. Results

After collecting data through questionnaires, NBM, and REBA, the researchers analyzed the data, and the results were as follows:

3.1. Frequency Distribution of Research Variables

Table 1 shows that most workers with work postures are at risk of experiencing CTDs complaints as much as 90.9% and not at risk as much as 9.1%, 71.2% female gender, and 28.8% male gender. Old age is 87.9%, and there is young age 12.1%. BMI is not at risk of 56.1% and is at risk of 43.9%. The ≥ 4 years of service is 95.5%, and the < 4 years of service is 4.5%, and there are very high CTDs complaints at 66.7%, high CTDs complaints at 22.7%, medium CTDs complaints at 9.1%, low CTDs complaints 1.5%.

Table 1 Distribution of Research Variables

Variable	n	%
Work Posture		
No risk	6	9.1
At risk	60	90.9
Sex		
Male	19	28.8
female	47	71.2
Age		
Young	8	12.1
Old	58	87.9
Body Mass Index (BMI)		
No risk	37	56.1
At risk	29	43.9
Years of service		
<4 Years	3	4.5
≥4 Years	63	95.5
Complaints of CTDs		
Low	1	1.5
Medium	6	9.1
High	15	22.7
Very high	44	66.7

3.2. Risk Factors Associated with Complaints of CTDs

After the univariable analysis was carried out, a bivariable analysis was carried out to determine the risk factors associated with CTDs complaints, while the results of the analysis are as follows

Based on Table 2, most workers with work postures are at risk of having very high CTDs (70%). The analysis showed a p-value of 0.001 ($p < 0.005$), indicating a significant relationship between work posture and CTD complaints. Most of the female workers had very high CTDs (70.2%). The analysis results showed p-value = 0.393 ($p > 0.05$), meaning there was no relationship between gender and CTDs. Most of the workers with old age had complaints of CTDs (67.2%). The analysis results showed p-value = 0.960 ($p < 0.05$), meaning that there was no relationship between age and complaints of CTDs. Most workers with BMI not at risk had very high CTDs (70.3%). The results of the analysis showed p-value = 0.429 ($p > 0.05$) = 0.005, which means there is no relationship between Body Mass Index (BMI) and CTDs complaints. Most workers with ≥4 years of service had complaints of CTDs (69.8%). The analysis results showed p-value = 0.003 ($p > 0.05$), meaning a significant relationship existed between tenure and CTDs complaints.

Table 2 Risk Factors Associated with CTDs Complaints

Variable	Complaints of CTDs										P-value
	Low		Medium		High		Very high		Total		
	n	%	n	%	n	%	n	%	n	%	
Work Posture											
No risk	1	16.7	2	33.3	1	16.7	2	33.3	6	100	0.001
At risk	0	0	4	6.7	14	23.3	42	70	60	100	
Sex											
Male	1	5.3	2	10.5	5	26.3	12.7	57.9	19	100	0.393
female	0	0	4	8.5	10	21.3	33	70.2	47	100	
Age											
Young	0	0	1	12.5	2	25	5	62.5	8	100	0.960
Old	1	1.7	5	8.6	13	22.4	39	67.2	58	100	
Body Mass Index (BMI)											
No risk	0	0	2	5.4	9	24.3	26	70.3	37	100	0.429
At risk	1	3.4	4	13.8	6	20.7	18	62.1	25	100	
Years of service											
<4 Years	0	0	2	66.7	1	33.3	0	0	3	100	0.003
≥4 Years	1	1.6	4	6.3	14	22.2	44	69.8	63	100	

4. Discussion

CTDs is an occupational disease caused by repetitive work activities, which is one of the ergonomic risks in the workplace. CTDs are one of the skeletal muscle disorders associated with repetitive activities and non-ergonomic work postures. CTDs are injuries that develop over time, which can take weeks, months, or even years [5]. Work posture is a risk factor that most need attention. If the work posture is ergonomic, the risk of experiencing CTDs decreases. Meanwhile, if the work posture is not ergonomic, the risk of CTDs increases [6]. The risk factors for CTDs complaints are categorized into worker, individual, environmental, and psychosocial factors [7, 8].

4.1. Work Posture as a Risk Factor for Complaints of CTDs

Working posture, namely the body position, which includes the neck, legs, torso, upper arms, forearms, and wrists of workers in the Indonesian spinning and dyeing factory, has a risky work posture category. This is caused by odd or extreme work postures for workers in the spinning and dyeing sections, such as repetitive work positions, standing positions, rotating bodies and wrists, raising arms, bending legs, and working processes that spend 8 hours per day operating the machine. So that this situation triggers complaints of CTDs. In this case, the Indonesian spinning and dyeing factory had to intervene with employees, especially in the production department, to stretch between working hours and a K3 monitoring system.

Work posture is a hazard where one of the risks is complaints of CTDs. CTDs are skeletal muscle injuries that increase gradually due to repetitive minor trauma. Poor work system design is one of the triggering factors for abnormal body movements [9]. Prolonged CTDs cause disability and result in reduced skills in carrying out work, decreased work productivity and high absenteeism for workers, besides that CTDs can cause disability in workers because, in addition to the pain they cause, they can cause restrictions on the functions of the limbs so that it affects daily work -day [4].

The results showed that most workers based on work posture were at risk with complaints of Cumulative Trauma Disorders (CTDs) of 60 workers. The results of the chi-square test P-value 0.001 indicate that there is a relationship

between work posture and CTD complaints. The results of this study align with research conducted by Muhammad Icsal (2016) in this study on tailors in the Pasar Panjang area of Kendari City, with an average worker having a difficult work posture and requiring improvement in body posture. He stated that there was a relationship between work posture and CTDs complaints [10]. This differs from Dhidit Kresno Waskito's research (2021) which shows no relationship between the categories of work postures and complaints of Musculoskeletal Disorders (MSDs).[11].

4.2. Sex as a Risk Factor for Complaints of CTDs

Based on the results of the study, it was shown that most workers based on sex were female, with complaints of CTDs from as many as 47 workers. The chi-square test results show no relationship between sex and complaints of CTDs in the Production Department at the Indonesian spinning and dyeing factory.

This study shows that female workers are more at risk of experiencing CTDs than male workers. This is because women tend to have lower muscle capacity than men. In the spinning section, particular expertise is required in the yarn spinning process. In the dyeing section, male workers are required because, in this section, the dyeing process requires strong muscle performance.

Physiologically, women's muscle capacity is lower than that of men. Women have a higher risk of injuries to their hands and wrists and neck and shoulder pain than men for all people and industrial workers. In this case, the big difference between women and men is related to their physiological abilities: muscle strength, muscle endurance, and cardiovascular endurance. Experience monthly cycles and menopause, while men do not [12].

4.3. Usia sebagai Faktor Risiko Keluhan CTDs

Based on the study's results, it was shown that most of the older workers had complaints of CTDs, totalling 58 workers. The chi-square test results have no relationship between age and complaints of CTDs. According to the worker's statement that complaints of CTDs on certain parts of the body are due to neglect, the worker considers this part of the job, and it is normal for this to happen at work. They are ultimately causing stability in the bones and muscles to be reduced. Besides that, the age factor is closely related to a decrease in bone elasticity, which triggers complaints of CTDs. As a result of increasing age, the level of fitness decreases. Musculoskeletal complaints will appear for the first time at age 35, often appearing with age [13].

Following increasing age, bone degeneration will occur, which begins when a person is 30 years old. At the age of 30, there is degeneration in the form of tissue damage, replacement of tissue into scar tissue, and decreased fluid. A decrease in significant muscle capacity is usually felt at the age of 35 years, and the rate of decline will continue to grow according to age. Meanwhile, if the age reaches 60, the average strength in the muscles will be reduced by 20%. When the muscles weaken, the impact will begin to be felt, for example, pain, weakness, and fatigue quickly [14]. Seeing this phenomenon, companies need to try to control the risk of CTDs in workers, for example, with fitness programs. Maintaining employee fitness is one of the company's responsibilities to create a healthy and productive work environment.

4.4. BMI as a Risk Factor for Complaints of CTDs

The study results showed that most workers with a BMI are not at risk of 18.5-22.99 having complaints of CTDs. The chi-square test results have no relationship between BMI and CTDs complaints. The observations in the field found that workers with normal BMI have physical activities that tend to be more active, so they can carry out activities with a fast frequency, which in the end, is what should be suspected as the trigger for CTDs complaints in workers with normal BMI. In addition, workers who have an average BMI are dominated by older workers. It was previously known that the older a person is, the risk of experiencing CTDs complaints; the ability to work muscles will decrease with increasing time. In previous research, it is known that age is associated with musculoskeletal complaints [15].

BMI is a simple indicator to monitor nutritional status, especially those related to underweight and overweight. The condition of a body that is too fat will be more at risk for experiencing complaints in the musculus-skeletal system. An overweight person will try to balance the load from the front by utilizing the back muscles. If the condition persists, there will be pressure on the spinal cord. In previous studies, subjects who were overweight/obese had a significantly higher prevalence of musculoskeletal complaints in the neck, shoulders, back, and hips compared to subjects with normal BMI. The lean group also had a significantly higher prevalence of musculoskeletal complaints in the neck area than the average weight group. Subjects who are overweight/obese and underweight are more likely to have MSD than subjects with average weight [16]. Good and systematic exercise habits can help reduce the risk of musculoskeletal complaints [17].

4.5. Years of service as a Risk Factor for Complaints of CTDs

Based on the study's results, it was shown that almost all workers with long working years had complaints of CTDs. The results of the chi-square test showed that there was a relationship between length of service and CTDs. The longer the working period, the higher the possibility of workers having CTD complaints. This is due to work activities with ergonomic risks carried out while working. The working period is when the worker enters work until the research occurs.

Tenure of work is the time a worker works calculated from when he or she is accepted. The longer the working period, the higher the sense of responsibility, belonging, and awareness of organizational goals, encouraging workplace productivity. The working period is related to the length of operation and worker activity, so it impacts muscle complaints. This can be exacerbated by ergonomic hazards in the workplace, for example, jobs that require repetitive movements and take place every day, and workers use much energy to complete the job. If the activity lasts a long time and continuously, the a higher risk of musculoskeletal complaints such as CTDs [18]

5. Conclusion

Based on the results of the study, it can be concluded that almost all workers have a challenging work posture, almost half of the workers are female, almost all employees are aged ≥ 35 years, BMI workers are not at risk, almost all workers have ≥ 4 years of service, and almost half workers have complaints of CTDs very high. Sex, age, and BMI are not risk factors for CTDs. Working posture and working period are risk factors for CTDs complaints.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have no financial or other potential conflict of interest to disclose.

Statement of informed consent

All respondents had obtained research information, filled out informed consent, and agreed to participate. Researchers maintain research ethics and ensure the confidentiality of the respondent's identity

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