



Research article

The Association Between Work-Related Musculoskeletal Disorders (WMSDs) Symptoms and Work Posture Among Courier Service Workers in Puncak Alam

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Abstract

The courier service industry is rapidly expanding, leading to an increased demand for deliveries and greater physical strain on workers. This heightened workload raises the risk of Work-Related Musculoskeletal Disorders (WMSDs). This cross-sectional quantitative study, conducted in courier service companies in Puncak Alam, Selangor, aimed to determine the prevalence of WMSD symptoms and their association with workers' postural angles. Descriptive statistics and the Chi-square test were applied for data analysis. Findings revealed the highest prevalence of WMSDs are found in the lower back (71.1%), followed by shoulders (63.2%). Significant associations were identified between neck position and WMSDs in the neck ($p=0.001$) and shoulders ($p=0.027$), trunk position with shoulders ($p=0.047$) and upper back ($p=0.017$), leg position with lower back ($p=0.030$), hips/thighs ($p=0.043$), and ankles/feet ($p=0.002$), and lower arm and wrist positions with respective WMSDs. The results suggest that awkward postures, such as frequent bending, twisting, and forward flexion, contribute to ergonomic hazards, highlighting the need for effective ergonomic interventions to prevent WMSD development.

Keywords: Work-related Musculoskeletal Disorders, Ergonomic risk, Courier service, Rapid Entire Body Assessment, WMSDs

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INTRODUCTION

Musculoskeletal Disorders, also abbreviated as MSDs, can be referred to as soft-tissue injuries caused by sudden or sustained exposure to repetitive motion, force vibration, and awkward positions, which can affect the muscles, nerves, tendons, joints, and cartilage (CDC, 2023a). MSDs are often characterized by pain and limitations in mobility and agility, which may lead to temporary and lifelong limitations in the functioning of body parts. Musculoskeletal conditions vary from short-lived conditions, such as fractures, sprains, and strains, to long-term

conditions like chronic primary low back pain and osteoarthritis. Some examples of MSDs include muscle sprains, strains, tears, soreness, pain, carpal tunnel syndrome, hernias, and connective tissue injuries (WHO, 2023).

Contemporarily, WMSDs have emerged as one of the leading occupational health problems in industrial countries. According to the World Health Organization, a recent analysis of the Global Burden of Disease (GBD) 2019 indicates that almost 1.71 billion people across the globe are suffering from musculoskeletal conditions (WHO, 2023). In Malaysia,

occupational musculoskeletal disorders ranked third in occupational disease and statistics of 2021 as issued by the Department of Statistics Malaysia (DOSM, 2023). Despite the occurrence of WMSDs in the workplace, ignorance persists since many do not fathom the genuine concept of WMSDs. Hence, many would perceive WMSDs as an ordinary condition that may heal over time. This issue is, however, very concerning since it may reduce people's productivity and capability to work. As well as causing pain and disability in the long term, MSDs may also contribute to absenteeism among workers and increase the cost of labor force injuries (Hosseini et al., 2019). This shows that the occurrence of WMSDs not only affects the workers' health but also burdens the business economy and the social costs of dealing with the consequences (Luan et al., 2018).

Courier service plays an integral role in the transportation of goods, especially given that the growth of e-commerce is accelerating across the globe, hence increasing the demand for parcel deliveries, be it internationally or domestically. Nonetheless, the nature of the work of courier workers exposes them to certain ergonomic risk factors, including awkward postures, repetitive motions, vibration, and prolonged standing. Awkward postures caused by unnatural postural angles can exacerbate the risk of WMSDs due to the exertion of muscles, tendons, nerves, and bones as movements reach the limits of the range of motion (CDC, 2023b). This issue is crucial to address to prevent the exacerbation of the risk of developing WMSDs over an extended period.

Since the courier service market is proliferating, there is a high demand for fast yet reliable delivery to customers. However, the increasing demand could jeopardize the workers' health to meet delivery deadlines and handle large packages. The increasing delivery demand puts a high physical demand among courier service workers, which increases the intensity of their physical work and will ultimately increase the risk of developing WMSDs (Silva et al., 2022). Therefore, the primary objective of the study was to determine the association between the postural angles and the prevalence of Work-Related Musculoskeletal Disorders (MSDs) symptoms among courier service workers at Puncak Alam.

METHODOLOGY

Sampling

A quantitative study with a cross-sectional design was conducted at courier service companies in Puncak Alam, Selangor, wherein the data was collected from October 2023 to January 2024. Through a convenient sampling method, all courier service workers, consisting of those who conduct manual material handling and customer service, were screened. Participants were recruited among those who fulfilled the inclusion criteria, which was that the workers must have worked in a courier service company for at least 12 months. Exclusion criteria included those who have only worked in the company for less than 12 months. On top of that, workers with trauma injury and personal records of WMSDs from any experience other than the current working environment at a courier service company were excluded. Written consent with participants signature is obtained before the participants are recruited, and those who refuse to participate would not be counted in.

The sampling size was based on Krejcie and Morgan (1970) table for determining sample size for a given population. Whereby based on estimated population of courier workers in Puncak Alam is 50 people, a total of 44 minimum respondents were required for this study.

This study comprises four discrete steps: direct observation of job tasks, Standardized Nordic Musculoskeletal Questionnaire (SNMQ), Rapid Entire Body Assessment (REBA), and data analysis to determine the association between postural angles and the prevalence of WMSD symptoms among courier service workers. Direct observation was conducted to observe the job tasks and the nature of work conducted by the selected courier

service workers. From the observation, potential risk factors that may contribute to the prevalence of WMSDs were determined. Standardized Nordic Musculoskeletal Questionnaire (SNMQ) was used to determine the prevalence of WMSD symptoms among courier service workers. This questionnaire focuses on the musculoskeletal symptoms most often experienced among workers in an occupational setting. The symptom sites, aided by a body map, were divided into nine anatomical regions: neck, shoulders, elbows, wrists/hand, upper back, lower back, hips/thighs, knees, and ankles/feet. Meanwhile, Rapid Entire Body Assessment (REBA) was utilized to analyze the postural angles of the workers while they were conducting their work tasks. Based on the postural angles of the workers, scores were assigned to each body segment, which includes the neck, trunk, legs, upper arms, lower arms, and wrists/hands.

The data obtained from the study was analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics were presented as mean, standard deviation, frequency, and percentage. Meanwhile, for inferential statistics, a chi-square test was utilized for normally distributed data to analyze the association between postural angles and the prevalence of WMSD symptoms among courier service workers. However, Fisher's exact test was utilized if the data was not normally distributed. All relevant assumptions were tested according to chi square's requirements and were assumed before the test. The significant level was set at $\alpha < 0.05$.

RESULTS AND DISCUSSION

Demographic characteristics of respondents

A total of 33 (86.8%) male participants participated in this study. Meanwhile, 5 (13.2%) of the participants were women, totaling up to 38 participants. Despite efforts to recruit the intended sample size of 44 respondents, only 38 respondents met the inclusion criteria and agreed to participate. The demographic data of the participants are summarized in Table 1. Results also shows that 26.8% of the respondents has 1 year work experience, 36.8% has been working for 2 to 3 years, 28.9% has 4 to 5 years work experience and only 7.9% have more than 5 years' work experience. As for Body Mass Index (BMI), nobody is recorded as underweight or obese. 78.95% of the workers has normal BMI and another 21.05% is in the overweight category.

Table 1: Demographic Background.

Variables	Classification of Variables	Frequency (n)	Percentage (%)
Gender	Male	33	86.8
	Female	5	13.2
Working Experience	1 year	10	26.3
	2-3 years	14	36.8
	4-5 years	11	28.9
	>5 years	3	7.9
Body Mass Index (BMI)	Underweight	0	-
	Normal	30	78.95
	Overweight	8	21.05
	Obese	0	-

Prevalence of WMSDs symptoms

The findings showed that the highest prevalence of WMSDs among the courier service workers within 12 months was lower back (71.1%), followed by shoulders (63.2%), upper back (60.5%), neck (47.4%), wrists/hands (44.7%), ankles/feet (21.1%), knees (18.4%). The body regions with the lowest prevalence of WMSDs were elbows (7.9%) and hips/thighs (7.9%). As for shoulders, 10.5% of the participants reported symptoms on their right shoulder, 52.6% reported symptoms on both shoulders, and 36.8% reported no symptoms on either shoulder. None of the participants has reported symptoms on the

left shoulder. As for elbows, 2.6% of the participants reported symptoms on their right elbow; none reported symptoms on their left elbow, and 5.3% reported symptoms on both elbows. Meanwhile, 92.1% reported no symptoms on either elbow. Finally, 15.8% reported symptoms on their right wrists/hands, 2.6% reported symptoms on their left wrists/hands, 26.3% reported symptoms on both wrists/hands, and 55.3% of the participants reported no symptoms at all on their wrists/hands.

Table 2: The prevalence of WMSDs symptoms within 12 months among participants.

Body Regions	Prevalence, n (%)	
	Yes	No
Neck	18 (47.4)	20 (52.6)
Shoulder	24 (63.2)	14 (36.8)
Right Shoulder	4 (10.5)	0
Left Shoulder	0	0
Both Shoulder	20 (52.6)	14 (36.8)
Elbows	3 (7.9)	35 (92.1)
Right Elbows	1 (2.6)	0
Left Elbows	0	0
Both Elbows	2 (5.3)	35 (92.1)
Wrists/Hands	17 (44.7)	21 (55.3)
Right Wrists/Hands	6 (15.8)	0
Left Wrists/Hands	1 (2.6)	0
Both Wrists/Hands	10 (26.3)	21 (55.3)
Upper Back	23 (60.5)	15 (39.5)
Lower Back	27 (71.1)	11 (28.9)
One or Both Hips/Thighs	3 (7.9)	35 (92.1)
One or Both Knees	7 (18.4)	31 (81.6)
One or Both Ankles/Feet	8 (21.1)	30 (78.9)

Table 3 demonstrates the prevalence of WMSD symptoms among the participants for the past 12 months and seven days for those who have had trouble. In the previous 12-month time frame, out of 60.5% of participants were reported to have been prevented from doing regular work due to lower back issues, 55.3% had shoulder pain, 42.1% had upper back issues, 31.6% had wrists/hands agony, 10.5% reported ankles/feet issues, 5.3% had knees pain and 2.6% experienced elbows and hips/thighs torment. Meanwhile, for the past 7-day period, 52.6% of the participants asserted that they had lower back issues, while 50% reported they had had issues for the shoulders, 26.3% for the upper back, 23.7% for the wrists/hands, 10.5% for neck, 5.3% for knees and ankles/feet, and 2.6% for elbows and hips/thighs.

Table 3: Prevalence of WMSDs symptoms for those who have had trouble within 12-months and 7-days period.

Body Regions	Prevalence, n (%)	
	12-months	7 days
Neck	8 (21.1)	4 (10.5)
Shoulder	21 (55.3)	19 (50)
Elbows	1 (2.6)	1 (2.6)
Wrists/Hands	12 (31.6)	9 (23.7)
Upper Back	16 (42.1)	10 (26.3)
Lower Back	23 (60.5)	20 (52.6)
One or Both Hips/Thighs	1 (2.6)	1 (2.6)
One or Both Knees	2 (5.3)	2 (5.3)

Body Regions	Prevalence, n (%)	
	12-months	7 days
One or Both Ankles/Feet	4 (10.5)	2 (5.3)

Body Postural Angles

Based on the findings, 55.3% of participants exhibited neck postural angles of less than 20°, while 44.7% had angles greater than 20°. The trunk postural angles distribution shows that 34.2% had angles less than 20°, 44.7% had angles between 20° and 60°, and 21.1% had angles greater than 60°. Most (63.2%) demonstrated leg postural angles between 30° and 60°, while 36.8% had angles greater than 60°. Meanwhile, for the upper arm, 13.2% of the participants had angles less than 20°, 47.4% between 20° and 45°, 36.8% between 45° and 90°, and 2.6% greater than 90°. On top of that, 44.7% of the participants exhibited lower arm angles within the range of 60° to 100°, while 55.3% had lower arm angles of either below 60° or above 100°. Last but not least, approximately half of the participants (47.4%) demonstrated wrist postural angles below 15°, while 52.6% had angles exceeding 15°.

Table 4: Descriptive analysis of postural angles by category of body parts

Postural Angles	Frequency (n)	Percentage (%)
Neck		
<20°	21	55.3
>20°	17	44.7
Trunk		
<20°	13	34.2
20°-60°	17	44.7
>60°	8	21.1
Legs		
30°-60°	24	63.2
>60°	14	36.8
Upper Arm		
<20°	5	13.2
20°-45°	18	47.4
45°-90°	14	36.8
>90°	1	2.6
Lower Arms		
60°-100°	17	44.7
<60° and >100°	21	55.3
Wrist		
<15°	18	47.4
>15°	20	52.6

Association between Postural Angles and Prevalence of WMSD Symptoms

Table 5 shows the analysis result between postural angles and the prevalence of WMSD symptoms according to body regions for the past 12 months. Some of the p-values show significance, which reflects the association between postural angles and the prevalence of WMSD symptoms. The findings concur that there is a significant association between neck position and prevalence of WMSDs at neck ($p=0.001$) and shoulders ($p=0.027$), trunk position and prevalence of WMSDs at shoulders ($p=0.047$) and upper back ($p=0.017$), legs position and prevalence of WMSDs at lower back ($p=0.030$), hips/thighs ($p=0.043$), and ankles/feet ($p=0.002$), lower arm position and prevalence of WMSDs at lower back ($p=0.037$), and wrist position and prevalence of WMSDs at wrists/hands ($p=0.046$).

Table 5: The association between postural angles and the prevalence of WMSDs symptoms for the past 12 months.

Prevalence of WMSDs	Postural Angles					
	Neck	Trunk	Legs	Upper Arm	Lower Arm	Wrist
Neck	<0.001*	0.480	0.804	0.861	0.492	0.732
Shoulders	0.027*	0.047*	0.420	0.660	0.859	0.671
Elbows	0.577	0.151	1.000	0.403	0.238	0.595
Wrists /Hands	0.116	0.088	0.240	0.298	0.360	0.046*
Upper Back	0.254	0.017*	0.717	0.839	0.389	0.463
Lower Back	1.000	0.259	0.030*	0.466	0.037*	0.200
Hips /Thighs	1.000	0.613	0.043*	0.746	1.000	0.232
Knees	0.678	0.405	0.387	0.619	0.104	0.222
Ankles /Feet	0.426	0.173	0.002*	0.659	0.257	0.697

*Significant at p-value <0.05

DISCUSSION

Prevalence of WMSD Symptoms

The nature of the work of the courier service workers in Puncak Alam was identified to involve awkward postures, repetitive movements, and heavy lifting, which can significantly contribute to WMSDs. A previous study conducted by Srinivasan et al. (2023) among delivery personnel also reported the highest prevalence at the lower back (30%) for the past 12 months, which aligned with this study. This can be attributed to the repetitive stress put on the musculoskeletal system and is most likely to be influenced by long working hours, general body posture, and improper handling techniques. Meanwhile, another study established the causes of low back pain to be associated with prolonged standing and sitting and carrying heavy objects (Khan et al., 2020). As such, the customer service workers were exposed to such factors as sitting hours. The nature of the work of the customer service workers mostly requires them to sit down, and improper sitting techniques may cause workers lower back pain, especially with longer working hours. Repetitive movements while scanning items and typing on the keyboard also cause workers to have musculoskeletal symptoms in their wrists.

The courier service workers in Puncak Alam were primarily identified as experiencing musculoskeletal symptoms due to awkward postures while unloading, carrying, and loading items. The participants were identified to adopt an excessive flexion posture, specifically when trying to reach out for items that were not within their range of reach. Overexertion while reaching may also contribute to shoulder pain, the second leading prevalence found in this study. The participants were also found to have been prevented from doing their normal work due to the presence of symptoms at the shoulder, denoted by 50% of the participants. This finding aligned with a study conducted by Silva et al. (2022), which revealed that shoulder flexion and extension may increase the risk of WMSDs, especially in activities of container parcel removal and vehicle loading.

Body Postural Angles

The findings revealed a notable 44.7% of the participants exhibited neck angles greater than 20°, indicating excessive bending of the neck. This explains the slightly higher prevalence of WMSD symptoms at the neck, whereby 47.4% of the participants exhibited symptoms. On top of that, 44.7% of the participants had trunk angles between 20° and 60°, and 21.1% had angles greater than 60°, indicating excessive trunk flexion and extension. During the assessment, most of the participants were identified to adopt a bending position, specifically during job tasks like lifting items from the ground and reaching distant items. Bending positions, in fact, pose ergonomic hazards to workers, as back region positions exert pressure on the intervertebral discs. The pressure can escalate by 20% to 100% when a person leans forward up to 20° to 40°. Furthermore, the pressure intensifies when adopting such a position while load lifting

(Ahmad et al., 2020). This aligns with the nature of the work of the courier service workers, which requires them to bend while carrying a load, hence posing them with the risk of WMSDs.

The low prevalence of WMSD symptoms at ankles and knees was mainly due to the nature of the work of the courier service workers, which typically does not necessitate an excessive bending of the leg. In certain instances, the participants were required to kneel while sorting items on low-level surfaces below knee height. During the assessment, the workers were found to adopt a high deviation of upper arm angles during manual handling tasks, namely lifting, loading, and unloading items. During these tasks, the workers were adjusting their upper arm positions to accommodate the size, weight, and height of the items being carried. Not only that, the tasks were also conducted in high repetition, which could further increase the strain put on the upper arms. The customer service workers were also observed to adopt awkward upper arm angles, specifically when reaching for items that were out of their range of motion. A similar study by Silva et al. (2022) demonstrated a dominant use of the upper limb during activities like vehicle loading, parcel container removal, and bar code reading.

The deviation of lower arm angles can mainly be seen during manual handling activities, especially when lifting and carrying items and loading and unloading items from the truck. The postural angles of the wrist are most likely influenced by the different ways of handling packages, as observed during the assessment. Wrist angles exceeding 15° may indicate extension, involving the bending of wrists. As such, tasks like lifting, carrying, and placing items may require different wrist positions, which could lead to discomfort and strain on the joints and muscles. The strain accumulation on the wrist could ultimately lead to WMSDs (Zhao et al., 2022).

Association between Postural Angles and Prevalence of WMSD Symptoms

Based on the assessment conducted using the REBA worksheet, it was observed that the association between neck position and the prevalence of WMSD symptoms at the neck could be due to prolonged neck bending, either downward or upward. Most of the respondents were identified to adopt downward bending of the neck while conducting manual handling, and the same goes for the customer service workers while conducting job tasks such as scanning items. Carrying items from the ground requires the workers to bend their necks downwards, causing strain on the muscles.

Neck position was also found to be associated with the presence of WMSD symptoms at the shoulders, which may be caused by the overexertion of muscles or bad posture while conducting job tasks. Yaghoubitajani et al. (2021) also emphasized the relationship between neck and shoulder pain, which was contributed by curved postures, prolonged and constant muscle activity, and repetitive job tasks. Reducing persistent neck pain and fostering a more relaxed muscle activity pattern at work can be attained by maintaining proper alignment of the upright body position to balance and restore muscle activity (Yaghoubitajani et al., 2021).

On top of that, trunk position was found to be associated with the prevalence of WMSD symptoms in the upper back. A similar study conducted by Ahmad et al. (2021) also reported a similar finding, whereby the position of the trunk is related to the presence of WMSD symptoms at the upper back. During the observation, the nature of the work of the courier service workers required frequent reaching and lifting, which promoted a bent or awkward position. Prolonged bending of the trunk while lifting and carrying loads can lead to increased stress in the musculoskeletal system, especially in the spine region, hence causing pain in the upper back (Zhao et al., 2022). Silva et al. (2022) suggested that the bending postures were mostly identified during container parcel removal and vehicle loading activities, posing a risk factor for lower back pain, which concurred with this study.

In addition, the prevalence of WMSDs at the wrist was identified to correlate with the position of the wrist. Findings from REBA reported 52.6% of the participants adopted postural angles of wrists at more than 15 degrees, which exceeded the recommended angle of 15 degrees (Zhao et al., 2022). As such, excessive bending or twisting of the wrist while handling and carrying packages can lead to strain and discomfort. Ahmad et al. (2021) also found that the awkward position of the wrist while doing tasks, like twisting and bending, correlates with the presence of WMSD symptoms at the wrists, contributed by the angle of the wrist and the force applied. Handling heavy packages, in particular, may require forceful gripping, which causes a significant strain on the muscles of the wrists (Ahmad et al., 2021). This was consistent with the results of a study that mentioned heavy loads in the pulling task during manual material handling, which showed a great total wrist score of Rapid Upper Limb Assessment (RULA) (Basahel, 2015).

Moreover, leg postural angles were found to be associated with the prevalence of WMSDs on hips or thighs and ankles or feet. Pal & Dhara (2017) suggested that the prevalence of WMSD symptoms on the lower limb is attributed to job tasks that necessitate kneeling, squatting, and sitting on the floor with folded knees. As such, when sorting parcels on ground level, the courier service workers were observed to bend their legs at the knee joints, adopting such postures. The sustained flexion of the hips and knees resulted in elevated pressure between the thigh and the gastrocnemius muscle of the lower leg. This consistent use of kneeling and squatting positions while conducting tasks significantly contributes to the development of WMSDs affecting the knees (Pal & Dhara, 2017).

Ergonomics interventions may be implemented to help with the identified risk factors. One of them is to train the workers in proper lifting techniques. Training on proper lifting techniques can help prevent WMSD. This includes bending at the knees, not the waist, and avoiding twisting and turning while lifting. Besides that, the government may also introduce some sort of incentive to gig workers or the service providers company for more ergonomics vehicle adjustments. Special regulations, guidelines or codes of practice could also be introduced to legislate the needs for ergonomics intervention in protecting the gig workers. Adjusting the seat, handle, steering wheel, delivery bag, and mirrors to fit the courier workers can reduce strain and improve comfort. This can help to prevent back, neck, and shoulder pain. Besides that, ergonomics equipment should also be encouraged to be used. Using equipment such as hand trucks, dollies, and adjustable seats can reduce physical strain. For example, a hand truck can help with moving heavy packages. Although most courier workers are considered as gig workers, companies should still invest in their health, safety and well-being as part of their responsibility. One of the programs to help with WMSD is Implementing health and wellness programs. This type of program can promote overall well-being. This could include exercise programs, stress management training, and access to health resources.

In addition, courier service companies could integrate the findings of this study into their occupational safety and health management systems by conducting periodic ergonomic risk assessments, redesigning workstations to minimize awkward postures, and ensuring workload rotation among employees to reduce repetitive strain. The government, on the other hand, could develop sector-specific ergonomic standards for gig and delivery workers, mandating minimum ergonomic requirements for delivery vehicles and package-handling equipment. Collaborative initiatives between courier companies, local councils, and research institutions could also be established to pilot ergonomic intervention programs and monitor their long-term impact on workers' musculoskeletal health.

The findings of this study contribute new insights by providing locally specific data on musculoskeletal problems among Malaysian courier workers; a group for which limited information currently exists. While previous international studies have

documented similar issues, the present study added regional context and extending the existing global understanding of occupational musculoskeletal health in the courier sector.

Limitations

Although the planned sample size was 44 participants, only 38 were successfully recruited for this study. This slight reduction in sample size may have marginally decreased the statistical power of the analysis, potentially limiting the ability to detect smaller effect sizes. Nevertheless, the consistency of the observed patterns with previous studies suggests that the overall findings remain reliable and meaningful. Future studies with larger sample sizes are encouraged to strengthen the generalizability of these results.

CONCLUSION

Most of the workers can be observed experiencing ergonomic hazards when they try to adopt awkward postures like frequent bending, twisting, and forward flexion of their postures, which lead to poor workplace design and working methods. The null hypothesis of this study expected that there is no significant association between the postural angles and the prevalence of WMSD symptoms among courier service workers in Puncak Alam. However, the findings demonstrated a significant association between the body's postural angles and the prevalence of WMSD symptoms. Therefore, based on the observed associations, the null hypothesis is rejected, which proves that the postures adopted while conducting tasks as a courier service worker have indeed contributed to the development of discomfort in certain body regions, which could ultimately result in the development of WMSDs. In order to advance the insights gained from this study, future research endeavors could benefit from exploring beyond the scope of postural angles and delving into additional ergonomic risk factors contributing to the prevalence of WMSD symptoms.

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