

ORIGINAL ARTICLE

PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG CASHIERS IN SELANGOR, MALAYSIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Work-related musculoskeletal disorders are common among workers. This study aimed to determine the prevalence of work-related musculoskeletal disorders (WMSDs) and risk factors among cashiers working in supermarkets. A cross-sectional study used a self-administered questionnaire comprising a Nordic Questionnaire and a Perceived Stress Scale among cashiers who were working in the supermarkets in Selangor with at least one year of work experience. A total of 162 subjects participated in the survey and 132 individuals (81.5%) reported that they had musculoskeletal symptoms in the last 12 months. The most affected body regions were the shoulders (95, 58.6%), followed by the neck (80, 49.4%), low back (79, 48.8%), and upper back (67, 41.4%). The predictors of shoulder symptoms were age, ethnicity, BMI, and height of check stand ($p = 0.003, 0.031, 0.02, \text{ and } 0.049$); the predictor of neck symptoms was ethnicity ($p = 0.031$); predictors of low back symptoms were age, ethnicity, stress, and absence of anti-fatigue mat ($0.003, 0.006, 0.042 \text{ and } 0.036$); and the predictors of the upper back were age, gender, and ethnicity ($0.004, 0.043 \text{ and } 0.042$). The prevalence of musculoskeletal disorders was high among cashiers, the shoulder was the most affected followed by the neck, low back, and upper back regions. In conclusion, utmost care should be given to areas that are at high risk for developing work-related musculoskeletal Disorders and cashiers must use the correct posture during working with appropriate breaks to reduce the risk of developing musculoskeletal disorders among cashiers.

Keywords: cashiers, work-related disorders, stress, risk factors, supermarkets

INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are a group of painful disorders that involve the nerves, tendons, and muscles¹. It can be episodic or chronic and caused by an injury sustained in a work-related accident. WMSDs can progress from mild to severe disorders and affect the quality of life of the adult population². Therefore, the risk factors which lead to WMSDs should be identified, in order to prevent work injuries. There are three main risk factors of WMSDs identified in epidemiological studies: physical factors, individual factors, and psychosocial factors³.

Grocery stores provide an important service in the country and are a major source of employment in the United States⁴. According to a report by the Bureau of Labour Statistics from Washington⁵, cashiers have been listed among the top ten involving WMSDs, which account for 9,300 cases in 2002. Ergonomics, as the physical factor, is the study of the workplace and the equipment design for comfort, efficiency, safety, and productivity. It is one of the main risk factors seen in retail grocery stores⁴. The intensity, frequency, and duration of exposure to ergonomic hazards will determine the

WMSD occurrence⁵. In addition to that, not only do the working environment and working posture of the cashiers contribute to WMSDs, but psychosocial factors are found to correlate to shoulder and neck symptoms among cashiers^{6,7}. The cashiers with a negative psychological perception of the work will have negative reactions to physiological and psychological stress on their own. However, combined with physical risk factors, psychological factors are only able leading to the occurrence of WMSDs⁸.

In Malaysia, the Social Security Organization (SOCSSO) in 2016 reported an escalated number of 1006 cases of occupational musculoskeletal disorders, the trend of cases that were reported increased exponentially since 2005⁹. However, the cases were not analysed based on the working field, therefore, no prevalence study of work-related musculoskeletal disorders among cashiers has been carried out in Malaysia. Therefore, this study was designed to determine the prevalence of work-related musculoskeletal symptoms among cashiers in Selangor, Malaysia, and which body parts were most likely to be affected among them.

METHODOLOGY

This was a cross-sectional study, with a volunteer sampling method used. The cashiers who worked in any supermarket with at least a year of working experience and aged below 55 years were considered for this study and recruited. A total of 162 cashiers have participated in this study.

A self-administered questionnaire attached to the consent form was translated into Malay and Mandarin languages and was validated by nine experts. The questionnaire consisted of 3 sections with open-ended and structured multiple choices with a consent form. The ethical clearance was approved by an institutional Scientific and Ethical Review Committee. All the respondents voluntarily participated in this study, and an informed consent form with an explanation of the study was signed before answering the questionnaire. The questionnaires were distributed to all eligible participants, and they answered on their own.

Section A consisted of two parts which were demographic data and working details of the respondents. Demographic data included age, gender, race, marital status, education level, height, weight, and hand dominance. Details of previous working experience and sustained injury, working duration, working hours, whether they have any other jobs, counter payment method, chair availability, sitting habits while scanning goods, bagging process, availability of assistance, and the direction of the conveyor belt were included.

Section B had the Nordic Questionnaire (sensitivity 66-92%; specificity 71-88%)¹⁰ to identify musculoskeletal symptoms during the last 12 months and last 7 days. The questionnaire included questions to determine whether the musculoskeletal symptoms prevented the individual from doing normal work at home or outside the home. It determined the musculoskeletal symptoms over body parts, including neck, shoulders, elbows, wrists, upper back, low back, hips or thighs, knees, and ankles or feet.

Section C comprised the Perceived Stress Scale (PSS), a standard stress assessment instrument, which determined participants' perceived stress levels. The questionnaire was made up of 10 questions and asked the thoughts and feelings of the subjects during the last month. There was a five points scale for each question, which is 0 (never), 1 (almost never), 2 (sometimes), 3 (fairly often), and 4 (very often). Some of the scores were reversed,

following the guideline before adding to obtain the total score. The scores from 0 - 13 were considered low stress, 14 - 26 considered moderate stress, and 27 - 40 considered high perceived stress.

Data analysis was based on the responses of the participants, data were analysed using SPSS software (Version 24.0, IBM Inc., Armonk, NY, USA). The descriptive analysis of the prevalence of musculoskeletal symptoms was presented as frequencies and percentages. Mann-Whitney U test and Chi-square test were conducted to determine the association between sociodemographic and workplace factors and work-related musculoskeletal symptoms. Logistic regression was used to test the predictors of the four most common body parts with Musculoskeletal Symptoms (shoulder, neck, lower and upper back) among the participants

RESULTS

A total of 162 subjects participated in the study which comprised males (30.9%) and females (69.1%). Their mean age was 26.90 (8.35). Participants' ethnicity was distributed to Malay (n = 104, 64.2%), Chinese (n = 23, 14.2%), Indian (n=16, 9.9%), and other races (n = 19, 11.7%). Table 1 shows the prevalence of musculoskeletal symptoms during the past 12 months (81.5%), and musculoskeletal symptoms that prevented the cashiers from doing their job was 31.5%. The most common musculoskeletal symptoms in different body parts for the past 12 months were shoulders 95 (58.6%), neck region 80 (49.4%), lower back pain 79 (48.8%), and upper back pain 67 (41.4%). The perceived stress scale among the participants showed that most of the respondents had moderate stress (n = 133, 82.1%), followed by low stress (n = 25, 15.4%) and high perceived stress (n = 4, 2.5%).

The marital status of the respondents was single (n=105, 64.8%), followed by married (n=50, 30.9%), divorced (n=6, 3.7%), and widow/widower (n=1, 0.6%). The majority of the cashiers stopped education after secondary school (n=116, 71.6%), followed by university (n=38, 23.5%), primary school (n=7, 4.3%), and others (n=1, 0.6%). The mean height of the respondents was 158.75 (12.85) cm, the mean weight was 60.40 (12.84) kg, and the mean Body Mass Index (BMI) was 24.85 (14.32) kg/m². As usual, right-handed participants (n = 142, 87.7%) were more than left-handed participants (n = 20, 12.3%).

Table 1. Musculoskeletal symptoms characteristics among the participants

Musculoskeletal symptoms	Frequency (n)	Percentage (%)	
Musculoskeletal symptoms during the past 12 months			
Yes	132	81.5	
No	30	18.5	
Musculoskeletal symptoms prevented cashiers from doing normal work			
Yes	51	31.5	
No	111	6.5	
Musculoskeletal symptoms for the past 7 days			
Yes	68	42.0	
No	94	58.0	
Shoulder	Yes	95	58.6
	No	67	41.4
Neck	Yes	80	49.4
	No	82	50.6
Lower Back	Yes	79	48.8
	No	83	51.2
Upper Back	Yes	67	41.4
	No	95	48.6

Table 2: Socio-demographic characteristics of the participants with and without Musculoskeletal Symptoms

Socio-demographic characteristics	Musculoskeletal Symptoms last 12 months		p-value
	Yes 132 (81.5%) n (%) / Median (IQR)	No 30 (18.5%) n (%) / Median (IQR)	
Age (Years) †	25 (8)	25 (11)	0.757
Gender †			
Male	36 (72.0)	14 (28.0)	0.038*
Female	96 (85.7)	16 (14.3)	
Race †			
Malay	90 (86.5)	14 (13.5)	0.156
Chinese	17 (73.9)	6 (26.1)	
Indians	12 (75.0)	4 (25.0)	
Others	13 (68.4)	6 (31.6)	
Marital Status †			
Single	87 (82.9)	18 (17.1)	0.728
Married	40 (80.0)	10 (20.0)	
Divorced	4 (66.7)	2 (33.3)	
Widow	1(100.0)	0(0.0)	
Education †			
Primary	4 (57.1)	3 (42.9)	0.194
Secondary	93 (80.2)	23 (19.8)	
University	34 (89.5)	4 (10.5)	
Others	1 (100.0)	0 (0.0)	
BMI Classification †			
Underweight	13 (86.7)	2 (13.3)	0.318
Normal	79 (84.0)	15 (16.0)	
Overweight	31 (79.5)	8 (20.5)	
Obesity	9 (81.5)	5 (18.5)	

† Mann-Whitney U test. † Chi-square test was conducted. *Significant results

The occupational characteristics of the respondents showed that the mean height of the check stand was 85.4 (5.52) cm and most of the supermarkets didn't provide an anti-fatigue mat (n = 157, 96.9%). The respondents had an average of 3.30 (3.27) years of working as a cashier and the mean working hours in a day was 9.52 (1.92) hours, the mean of working days per week was 5.98 (0.27), and the mean working hours per week was 56.93 (11.87) hours. None of the participants had any other job at the same time.

Chairs were provided in most of the counter (n = 107, 66%), but it was not provided in some of the counter (n = 55, 34%). Out of 107 respondents who had a chair provided at the counter, most of them never sit when scanning goods (n = 57, 53.3%), followed by sometimes sitting (n = 34, 31.8%), almost never sitting (n = 15, 14.0%), and very often sit (n = 1, 0.9%), none of the participants selected fairly often sit during scanning goods. The number of cashiers with sideway check stands was 135

(83.33%) and with front-facing check stands 27 (16.67%). Mann-Whitney U test was performed to determine the association between age and musculoskeletal symptoms. The median age cashiers had or didn't have musculoskeletal symptoms was 25. TABLE 2

As shown in Table 2, the difference in the musculoskeletal symptoms between ages was not statistically significant at p = 0.757. A Chi-square test was performed to determine the association between gender and musculoskeletal symptoms. The number of affected males (n = 36, 72.0%) was lower than the number of affected females (n = 96, 85.7%). The difference in the musculoskeletal symptoms between genders was statistically significant (p = 0.038). There was **no significant association** between the prevalence of musculoskeletal symptoms and other socio-demographic characteristics of the respondents such as race, marital status, education level, and BMI classification. TABLE 2

Table 3: Occupational Characteristics of the participants with and without Musculoskeletal Symptoms

Occupational Characteristics	Musculoskeletal Symptoms last 12 months		p-value
	Yes 132 (81.5%)	No 30 (18.5%)	
	N (%) / Median (IQR)	N (%) / Median (IQR)	
Handedness ^π			
Left-handed	15 (75.0)	5 (25.0)	0.425
Right-handed	117 (82.4)	25 (17.6)	
Availability of anti-fatigue mat ^π			
Yes	5 (100.0)	0.0 (0)	0.279
No	127 (80.9)	30(19.1)	
Height of check stand (cm) [†]	86 (8.5)	89 (8.1)	0.291
Position of Check Stand ^π			
Sideway	108 (80)	27 (20)	0.278
Front Facing	24 (88.9)	3 (11.1)	
Availability of chair ^π			
Yes	84 (78.5)	23 (21.5)	0.174
No	48 (87.3)	7 (12.7)	
Sitting habit during scanning goods ^π			
Never	44 (77.2)	13 (22.8)	0.799
Almost never	13 (86.7)	2 (13.3)	
Sometimes	26 (76.5)	8 (23.5)	
Very often	1 (100.0)	0 (0.0)	
Working (Years) [†]	2.17 (2.75)	2.42 (3.87)	0.429
Working per day (hours) [†]	9.00 (4.0)	8.00 (4.0)	0.736
Perceived Stress Scale ^π			
Low stress	16 (64.0)	9 (36.0)	0.036*
Moderate stress	112 (84.2)	21 (15.8)	
High stress	4 (100.0)	0 (0.0)	

[†] Mann-Whitney U test. ^π Chi-square test was conducted.

Table 3 shows the results of different statistical analyses conducted to find out the association between the musculoskeletal symptoms and selected occupational characteristics of the respondents such as left or right-handed, availability of an anti-fatigue mat at the workstation, the height of the check stand, position of the check stand, availability of a chair, sitting habits during working, seniority and working hours

per day and all the results showed there was no significant association with musculoskeletal symptoms. The results of the survey used a perceived stress scale among the respondents and showed respondents with moderate stress had a higher level of musculoskeletal symptoms as compared to low and high stress and the difference was significant (p=0.036). TABLE 3

Table 4: Predictors of the four most common body parts with Musculoskeletal Symptoms among the participants

Independent Variables	Most common Musculoskeletal Symptoms based on body parts			
	Shoulder 95 (58.6%)	Neck 80 (49.4%)	Lower Back 79 (48.8%)	Upper Back 67 (41.4%)
Age ¹	1.126	1.068	1.124	1.126
	0.003*	0.058	0.003*	0.004*
Gender ²	1.039	1.1153	1.468	3.595
Male Reference (female)	0.945	0.790	0.513	0.043*
Race ²	3.299	3.237	5.019	3.458
Malay Reference (Chinese and Indians)	0.031*	0.031*	0.006*	0.042*
Education ²	0.809	1.705	0.549	0.926
University Reference (Below University)	0.722	0.348	0.340	0.902
BMI categories ³	0.164	0.670	0.794	0.950
	0.020*	0.305	0.584	0.902
Stress ³	0.984	3.073	3.881	1.774
	0.977	0.065	0.042*	0.373
Dominant Hand ²	2.417	1.358	0.914	0.837
Right Reference (Left)	0.240	0.677	0.909	0.811
Height of the Check Stand ¹	0.808	0.881	0.874	0.970
	0.049*	0.200	0.200	0.773
Availability of anti-fatigue mat ²	0.240	0.146	0.041	0.102
Yes Reference (No)	0.240	0.137	0.036*	0.072
Working Period in years ¹	0.892	0.991	1.022	1.148
	0.159	0.903	0.789	0.119
Working hours per day ¹	1.220	0.946	1.280	0.936
	0.206	0.692	0.107	0.669
Working days per week ¹	0.528	0.317	0.447	0.426
	0.366	0.178	0.249	0.222
The direction of the check stand ²	1.034	1.814	0.734	0.618
Side-facing Reference (Front facing)	0.946	0.257	0.522	0.344
Sitting during scanning ³	1.592	1.335	1.361	1.268
	0.079	0.257	0.261	0.387

Binary logistic regression to detect the predictors for the top four musculoskeletal symptoms (Shoulder pain, Neck pain, Lower back pain, and Upper back pain). There are workers with more than one complaint. The data is presented with OR (Odds Ratio) and p-value. ¹ continuous data, ² nominal data, and ³ ordinal data that analysed as continuous data. BMI is classified into underweight, normal, overweight, and obesity. Sitting during scanning classified into never, almost never, sometimes, and often. Stress is classified as low stress, moderate stress, and higher stress.

Binary logistic regression was conducted (as shown in Table 4) to determine the predictors for the areas which most exhibited the musculoskeletal symptoms such as - the shoulder (58.6%), neck (49.4%), lower back (48.8%), and upper back (41.7%). Three different types of independent variables were involved in the model. The first was continuous data age, working experience in years,

working hours per day, and height of the check stand. The second type was binominal variables gender, race, education, hand dominance, availability of anti-fatigue mat, and direction of the check stand. The last variable was ordinal, which analysed the binary logistic model as continuous data, BMI categories (underweight, normal, overweight, and obese) and sitting during scanning

(never, almost never, sometimes, and often), and stress (low, moderate, and high). All the assumptions of the binary logistic regression were fulfilled and the continuous data linearity with respect to the dependent variables was assessed using Bonferroni correction and the continuous independent variables were found to be linearly related to the logit of the dependent variable.

For shoulder pain, over the thirteen predictors only age ($p = 0.003$), race ($p = 0.031$), BMI categories (0.02), and height of the check stand ($p = 0.049$) were significantly associated. The odds ratio of having shoulder pain was significantly higher among elder cashiers as compared to young, Malay workers had more chance to develop shoulder pain compared to Chinese and Indians. Cashiers who were underweight had higher chances to develop shoulder pain as compared to those who were overweight or obese. Also, the height of the check stand was lower among those who developed shoulder pain.

Neck pain was significantly associated with race as the possibility of developing neck pain was significantly higher among Malays as compared to Chinese and Indians ($p = 0.031$). The elder workers had higher chances of developing lower back pain ($p = 0.003$), considering race ($p = 0.006$) the probability of having lower back pain was significantly higher among Malay workers as compared to Chinese and Indians. the chance of developing lower back pain was significantly higher among those with low-stress levels. finally, the odds of having lower back pain were lower among workers who were using an anti-fatigue mat ($p = 0.036$). the upper back pain dependent variable was significantly associated with age ($p=0.004$), gender ($p = 0.043$), and race ($p = 0.042$). thus, the probability of having an upper back was higher among elderly workers, among males, and among the Malays population. TABLE 4.

DISCUSSION

To determine the prevalence of work-related musculoskeletal disorders (WMSDs) and risk factors among cashiers working in supermarkets, most of the cashiers were assigned to different counters every day, and only a few counters might not have a card payment method. Due to the same reason, some supermarkets have cashier counters with two directions of the conveyor belt (from left to right and vice versa), so the researchers define this kind of design as the other variable, called mixed direction. In the same case, almost all the supermarkets have a front-facing design express counter, but none of the cashiers' duties was fixed on that counter. Therefore, the front-facing counter choice is only representing the

supermarkets that applied front-facing check-stand without side-way direction check-stand design.

This study investigated and discussed the prevalence of work-related musculoskeletal disorders (WMSDs) among body areas which were based on the Nordic Questionnaire among cashiers in Selangor, Malaysia. The findings showed that 81.5% of cashiers complained of musculoskeletal symptoms during the past 12 months; 42% complained of the symptoms during the past 7 days. 31.5% of cashiers claimed that musculoskeletal symptoms prevented them from doing normal work. However, the recent study only discusses WMSDs based on body parts, and the findings of general prevalence couldn't be compared. The presence of musculoskeletal symptoms can affect activity in daily life and working performance¹¹.

Even though the government had implemented the policy of imposing a 20-cent charge for each plastic bag upon request¹², during the time of the interview, the researcher found out that most of the time the cashiers were still helping customers bag the groceries. In some of the supermarkets, they provided an assist to the cashiers for bagging groceries, but only during weekends and holidays, when there was a huge population to be handled. Therefore, the variable of availability of assistants is not consistent, and may not be suitable to be concluded in the study. Among all the body parts, shoulders (58.6%), neck (48.4%), low back (48.8%), and upper back (41.4%) were more affected. Remarkably, wrists (25.9%) and elbows (16.4%) were the least affected body parts of all.

A recent study showed that the prevalence of shoulder pain is 46.4% among female cashiers¹³ and 66% among both genders¹⁴. In this study, the finding fell between the 2 reported studies. This could be explained by the fact that cashiers are required to repeatedly lift both light items and heavy items, and frequently turn items to find the EAN code before scanning. Others, while waiting for the items to reach through the conveyor belt, abducted their shoulder and repeatedly lifted the items instead of waiting. A study has reported the main factor of upper limb musculoskeletal disorders was monotonous repetitive movements¹⁴. The findings are consistent with other researchers who have concluded that repetitive movements of the upper limbs lead to shoulder pain¹³.

Regarding the neck, studies showed that psychosocial factors are also related to the neck musculoskeletal symptoms^{15,6}. The study recommended a 20 - 30 degree of static neck flexion for the prolonged working period, but cashiers tend to have a lesser degree of flexion in either sitting or standing position¹⁶. This results in neck muscle

overload, causing injury and pain^{16,17}. In the upper back, the fatigue of the neck muscles causes more upper back muscles to be activated and indirectly leads to upper back musculoskeletal symptoms¹⁸. The cashiers repeatedly performed shoulder abduction when lifting the items from the conveyor belt, this not only increases stress on the shoulders but the upper back too¹⁹.

Similarly, researchers²⁰ reported that cashiers flex the shoulder and trunk while reaching for the items on the conveyor belt, leading to postural stress. In this study, more than half of the cashiers reported never or almost never sitting while scanning. Prolonged standing without the “freedom” to sit during working will lead to low back pain including muscle pain due to ligament and muscle fatigue; unable to support the spine and maintain an upright posture²¹. It has been reported that the wrist is more prone to injury, due to poor workstation layout, improper scanning techniques, and handling heavy items with the wrong technique²². Cashiers were required to perform high-intensity manual work, without adequate recovery time in between, which led to impairment of the median nerve²³. Carpal tunnel syndrome and tenosynovitis are common symptoms found in the wrist region²². Another study done in 2007 showed that the prevalence of carpal tunnel syndrome among cashiers is 31%, which is higher than this study²³.

In the lower limb, which had not been discussed in the recent prevalence studies among cashiers. Ankles and feet had the highest percentage of musculoskeletal symptoms, 33.3%, followed by knees (29%) and hips (19.8%). Cashiers spent most of their working hours standing in the same place; the main factor causing lower limbs, ankle, and foot pain²⁴. Prolonged standing leads to blood flow restriction to the lower limbs, causing venous supply insufficiencies. This causes muscle fatigue and increases the level of discomfort in the region of lower limbs²⁵. Elbows were the least affected among all the other body parts in this study. It is because the nature of the work of cashiers is a repetitive activity in prolonged static posture without applying force, unlike the butcher who is more likely to develop musculoskeletal symptoms at the elbow due to the repetitive force applied. Thus, this study showed no association between repetitive work and elbow pain²⁶.

This study showed that gender was significantly associated with symptoms ($p < 0.05$), and females were more prone to musculoskeletal injuries. This finding is similar to many previous studies which reported that the female population had predominant musculoskeletal symptoms among the general population²⁷ and cashiers¹⁴. Health complaint is affected by social and individual

expectation. Therefore, different individuals may have different perceptions and understanding of pain. Studies show that females are more aware of their own body conditions and it is more socially acceptable for females to complain about pain²⁸ while another survey reported women were in the front line regarding risks associated with organizational strain or psychosocial factors such as repetitive work, high demands, low control and low social support representing 58% of recorded cases of work-related musculoskeletal disorders²⁹. This study showed that there was no significant difference in musculoskeletal injury reported among the different races. Data from³⁰ data from the 1988 Occupational Health Supplement reported that there was no association between ethnicity and nonfatal occupational injury at work. However, only Caucasians and Africans were discussed in the paper. In contrast, a study done in Malaysia showed that the Indian population showed a higher yearly mean incidence rate of nonfatal occupational injury than the Malays and Chinese populations. This data was retrieved from PERKESO (SOCO -Social Security Organisation from a general working population³¹, which explained that Indians were more likely to hold a high-risk job, such as machine operators and assemblers, and such confounding variables resulted in showing a higher prevalence of WMSDs among Indian workers. Therefore, the general working population may not truly represent the cashier population in Malaysia, the ethnicity is not defined as a risk factor for musculoskeletal injury.

There is no significant association found between educational level and musculoskeletal symptoms in this study. However, many studies showed that there was an association between educational level with work-related musculoskeletal injuries³². Individuals with higher educational levels may have a higher awareness of health and tend to prevent it. Even though the educational level did not be mentioned in a previous prevalence study among cashiers, it may be because cashier does not require a high educational level, and most of the cashiers have the same educational level. The risk of musculoskeletal symptoms increases in the hip and knee when the person has a higher categorical BMI in the general population³³. However, this study did not show a significant association between BMI and lower limbs which could be explained by the nature of work requiring cashiers to work in a prolonged standing position, being the main risk factor causing musculoskeletal symptoms in lower limbs and not in hips and knee.

Studies suggested that an anti-fatigue mat effectively reduced the pain in the lower back and lower limbs for individuals who required prolonged standing³⁴. However, only 5 cashiers in this study were working using an anti-fatigue mat which was

too small a sample to show significant findings. The availability of a chair is supposed to enable lower limb musculoskeletal symptoms, but there was not any significant association between the availability of a chair and lower limb musculoskeletal symptoms. This factor has never been discussed in the previous prevalence study. The researcher in this study suspected that cashiers are required to prolonged standing while serving customers and most of them did not sit when serving customers, which means that the cashier did not have the freedom to sit during working, thus leading to lower limb muscle fatigue and pain³⁵. From the other point, the respondents who more often sat during scanning work had less likely chances to have lower limb musculoskeletal symptoms. However, the correlation between these two variables is not statistically significant ($p = 0.689$).

In the shoulder, sitting habits and sideway checks and design had been mentioned as risk factors. Generally, muscle loading is generally lower in a standing position, this is due to the fact that cashiers are working in a seated position, the scanning works and picking groceries works are above elbow level, and abduction of the shoulder is more required to be performed, it causes more stress on neck and shoulder¹⁶. In the researcher's findings, scanning more often in a seated position showed a slightly higher chance of causing shoulders musculoskeletal factors, but a significant difference was not found. This is because most of the respondents (99.1%) selected never, almost never, or sometimes as their sitting habit during scanning goods, but none of them choose fairly often, and only one of them chose very often. Therefore, there's no big difference between the sitting habit among all the cashiers, which explains the non-significant association between these two variables.

Compared to the sideway direction check stand, the front-facing check stand design is more ergonomically friendly, because it allowed cashiers easier to take items more without abducting shoulder or trunk rotation¹⁴. Other than that, front-facing check stands are usually found in the smaller supermarket, where the workload might be lower compared to the large supermarket. However, the results showed more shoulders complained with the sideway direction check stand design, but it was not significantly associated with the shoulder musculoskeletal symptoms. It may be due to the length of the sideway direction check stand being short enough, allowing the cashiers to perform minimal abduction of the shoulder without aggravating the musculoskeletal symptoms.

The study showed that there was a significant difference in musculoskeletal injuries with stress levels ($p = 0.036$), and it is the same with other

research findings^{6,13,15}. Cashiers are required to prolong standing during working, this not only leads to muscle fatigue, but it causes psychological fatigue at the same time³⁶. Besides that, there were numerous psychosocial factors reported that contributed to stress, such as fewer development opportunities, heavy work tasks, little or no control over the job, and a heavy workload⁶. Psychological stress increases the tension of the muscles and causes changes in the hormones, adrenaline, and noradrenaline, and in the end, the immune system of the body is jeopardized³⁷. In the end, without taking proper care of stress issues, physical work stress, and mental stress the workers are more prone to muscle pain⁷.

Our study showed that there was no association between age with musculoskeletal injuries. Aging is associated with the degeneration of tendons and cartilage, which leads to a higher risk of WMSDs¹³. A study from Canada analyzed 270,000 workers and conclude that the risk of musculoskeletal injury was highest in middle-aged workers which are 35 to 44 years old³⁸. The elder age group of workers didn't show a high prevalence of musculoskeletal injury may due to the healthy worker effect³⁹. From this study, 141 (87%) of respondents were below 35 years old, which explains the non-significant results.

If the check stand was too high, the cashiers might lift up their shoulders and be required to perform more degrees of abduction; if the check stand was too low, the cashiers might bend their trunks in order to perform the work smoothly. Our findings showed that there was no statistical difference between the height of the check stand with the lower back and shoulders. The height suitability of a check stand is depending on different individuals because everyone has a different height and elbow level. Therefore, the researcher's findings which showed an average check stand height of 85.24 ± 5.52 cm may be suitable for most cashiers in Malaysia, so no significant correlation between these two variables was shown.

This study reported an average check stand of 85.24 ± 5.52 cm which may be the most suitable check stand height for Malaysian cashiers but no significant association was reported between check stand height and the WMSDs of all regions. This study found that there was no association between working years and overall musculoskeletal symptoms. However, all the body parts showed a higher prevalence in cashiers who worked for more than 10 years. Another study found that cashiers with more than 10 years of working experience had a greater risk of musculoskeletal complaints, while others showed a higher risk of musculoskeletal complaints among 5 - 10 years of working

experience cashiers¹⁵. In contrast, a study from another field showed that new individuals are more prone to musculoskeletal injury than experienced workers because the new individuals are not familiar with the work and are unable to acknowledge ergonomics risk factors⁴⁰. Alternatively, as the duration of working years increases with age, age may be the other confounding variable for musculoskeletal symptoms.

This study shows no statistical significance between working hours and musculoskeletal symptoms, but higher working hours showed more prone musculoskeletal symptoms. Based on an article review, workers who worked 10 hours per day had a 15% higher risk of work injury compared to those who worked 8 hours per day⁴¹. Long hours of working induce stress and fatigue, which not only increase the risk of a work injury but also affect individuals' mental and physical health in many aspects⁴². At the same time, workers with long working hours tend to have not enough sleep, which reduces work performance⁴³. In our study, the customer flow had not been considered, so the cashiers with the same working hours may not have the same workload, and the risk of injury might be different. Therefore, the workload might lead to the working hours were not significantly associated with musculoskeletal symptoms.

There are many risk factors causing musculoskeletal symptoms among cashiers, including physical factors, psychological factors, and ergonomics issues. Significant associations are found between genders, PSS with musculoskeletal symptoms, and working years are associated with upper back and knee musculoskeletal symptoms. Even though other risk factors may not show a significant association between musculoskeletal symptoms, extra care should be taken to reduce the risk of work injury.

Limitations

There were a few limitations in this cross-sectional study. This study does not allow cause-effect relationships between WMS symptoms and sociodemographic and workplace factors from the perspective of methodology, the researchers due to the inability to create the sampling frame, volunteer sampling was used. This study was urban-based, which will not represent the whole population of cashiers in Malaysia.

Recommendations

Based on the researcher's observation, the workload of the cashiers and the flow of customers are different in the supermarkets. These factors may be the vital factors that contribute WMSDs. Therefore, the researcher suggests that by videotaping the cashier's work, the workload of the cashiers can be quantified. At the same time, the

posture of the cashiers can be observed and analysed. Thus, future studies should consider these recommendations in future studies. A larger sample size is recommended in future studies. A random sampling method is highly recommended in the future. Besides, the researcher suggests that getting permission to face interview the cashiers, can increase the accuracy of the study. Future researchers should interview the store manager or supervisor to determine whether the companies are aware of ergonomics and WMSDs. The morning exercise session is conducted in some of the supermarkets. This kind of activity may improve the general physical and mental health of the workers; such a variable should be included in future studies.

CONCLUSION

This study aimed to determine the prevalence of work-related musculoskeletal injuries (WMSDs) among cashiers and to find the most affected body parts and associated factors. Our result showed a high prevalence of work-related musculoskeletal disorders among the cashier population (81.5%) during the past 12 months. The most affected body parts included shoulders (58.6%), neck (49.4%), low back (48.8%), and upper back (41.4%); followed by ankles or feet (33.3%), wrists or hands (25.9%), hips or thighs (19.8%) and elbows (16.4%). Extra care should be given to these body parts, and a correct posture with frequent breaks between works should be applied to reduce the risk of injury.

There's a significant association between working years with upper back and knees musculoskeletal symptoms. Genders and Perceive Stress Scale (PSS) are significantly associated with musculoskeletal symptoms. Working years and genders are not modifiable risk factors. However, the stress level can be improved by a positive working environment, which can reduce the symptoms of WMSDs. Even though there is no significant association found between the sitting habit during scanning, the direction of the check stand, and total working hours per week with musculoskeletal injury, the findings showed these factors are prone to musculoskeletal symptoms. Further study of the causal relationship between these variables is required. Although there's a lot of improvements are required to be made in the study, being the first cross-sectional study to determine WMSDs among cashiers in Malaysia, it gives relevant and fundamental information and acts as a stepping stone for future studies.

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