THE RELATIONSHIPS BETWEEN MUSCULOSKELETAL DISORDERS AND ANTHROPOMETRIC INDICES IN PUBLIC VEHICLE DRIVERS

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ABSTRACT

Introduction: Musculoskeletal disorders (MSDs) are very common amongst drivers. According to the previous studies, MSDs and back pain are two main causes of car accidents.

Objective: This study investigated the relationship between body dimensions of drivers and the form of this type of disorders.

Method: The sample included 95 bus drivers selected randomly. As instructed, the drivers described the levels of discomfort in different parts of their bodies, based on the BDC chart. In the meantime the dimensions of their bodies' were measured. Then, using the Spearman test, the associations between anthropometric dimensions and MSDs were investigated.

Result: The results showed that MSDs are related to the height, weight and age of drivers. In other words, the more weight and age, the more probability of MSDs; while the height of drivers showed the reverse association.

Conclusion: In conclusion, when recruiting, the younger, taller and healthy people should be selected to minimize the MSDs; and therefore, car crashes and accidents.

Keywords: Anthropometric Indices, Musculoskeletal Disorders, Drivers

Introduction

MSDs[1] are formed gradually in people who have inappropriate position when working. These type disorders may cause muscular pains and skeleton damages in different parts of body such as waist, shoulders, arms and hands. MSDs also increase the possibility of disc hernia [1]. Public vehicle drivers showed to have a higher prevalence of MSDs, compared to other careers [2]. In view of the fact that the drivers spend long times behind wheels, MSDs are progressively formed over time; which may have considerable impacts on their personal and social life [1]. The evidence showed that the people driving at least half of working hours each day suffer three times more than other workers [3]. High prevalence of spinal disorders observed among professional drivers, especially back and neck pain, usually lead to constant suffering and disease and probably pre-retirement. [4]. A review article claimed that these discomforts are due to physical, psychological and ergonomics stressors [5]. Another study in Japan that examined the risk factors of back pain reported that the prevalence of back pain among 285 taxi drivers was 45.8% which is consistent with other studies. [6]

Miyamoto and his colleagues in an epidemiological study revealed that the prevalence of back pain among 153 truck drivers was 50.3%. The results also showed that the back pain was significantly associated with the fittingness of driver's seat, the driven distance, the roughness of road which related to the amount of vibrations and work-related stress, as well as, their working history. [7].

In another study in the north of India, Kumar and his colleagues found that the prevalence of occupational back pain among tractor-driving farmers was about 40% higher than the other farmers who did not drive tractors [8].

A reviewed study on motor vehicle drivers and heavy equipment operators found that driving as a job could cause back disorders since their tasks need the certain postures and involve activities such as lifting; which are related to those disorders. [9].

Rehn in his Ph.D. thesis studied MSDs among drivers of forestry machinery and snow plough-equipped. He discovered that the symptoms of MSDs in neck and upper limbs could be associated with long exposure to overwhelming vibrations and inappropriate posture during driving. [10]

The relative risk of disc hernia among truck drivers appeared to be four times higher than the other drivers, according to a study in Finland. This study revealed that there was a significant probability for motor vehicle drivers to be admitted in hospitals due to protrusion of nucleus pulpous [11]. Medical reports stated that, in general, MSDs contribute 78% of all diseases, 14% of all doctor calls, and 15% of total hospital admissions. Moreover, health statistics revealed that approximately 62% of patients with MSDs are suffering from mobility limitations. Furthermore, the total cost of MSDs in Canadian drivers in the period of 1996-2000 showed that this career was in the third place of claiming the indemnification for MSDs; so that, the insurance companies had to deal with 4337 cases. [12].

[1] Musculoskeletal Disorders

Material and Method

In this study, the extent and prevalence of MSDs, as well as, the levels of discomforts among drivers were investigated. In addition, the relationship between the dimensions of driver's body and the extent of discomforts was studied. This analytical, cross sectional study includes two parts in which 95 bus drivers were randomly selected as samples. To prevent repetition, systemic coding was used for both buses and drivers. At first, the cases got the required instruction; then anthropometry was completed and the drivers filled in the BDC[2], as instructed.

2.1. **Anthropometry**

Anthropometry or the measurement of body's dimensions is a subcategory of physical anthropology and it is related to the different parts of body's dimensions, body's movements and the strength of muscles [13]. Regarding the study objectives, we selected specific dimensions. These dimensions included height, weight, and the length of upper limbs, the length of hands, arms, thighs and knees. Weight was measured by Kilogram, and scale of the other parameters was centimetre. Anthropometry was completed through measuring the bodies dimensions, using, stadiometer, weighing scale and stadiometer seat. Then, the drivers' BMI[3] was calculated. Finally, the outcomes categorized and defined as below:

BMI: lower than 19.8: under weight, BMI: 19.8-26: normal, BMI: 26-29: overweight, BMI: higher than 29: obese [14].

2.2. Body discomfort Chart

We investigated MSDs using Body Discomfort Chart. BDC is a technique which assesses the degree of subjective discomfort that individuals experience.[15] BDC consists of two parts; the first part covers demographic and background information, In the second part, drivers were asked to define their discomforts according to the following categories: Without discomfort, Mild discomfort, Moderate discomfort, Severe discomfort.

This chart includes discomforts in neck, shoulder, arm, elbow, hand, forearm, fingers, thigh, knee, leg, ankle, Upper back, and Lower back. We categorize these discomforts as follows: Mild discomfort is bearable. Moderate discomfort needs medications. Severe discomfort causes lack of ability in daily tasks.

After collecting, data were analyzed applying SPSS software. Descriptive statistics including average, standard deviation and range were computed for data series. Then, the relationships between MSDs and anthropometric dimensions were investigated, employing Spearman coefficient correlation test.

[2] Body Discomfort Chart

[3] Body Mass Index

Results

The deriver's age ranged between 26-56 years old with standard deviation of about 7.65. The descriptive anthropometric results are presented in Table1.

Table1 goes here.

The BMI findings revealed that 4.21% of drivers were underweight. BMI of 49.47% of drivers was normal. 17.89% of drivers were overweight; and 28.42% of drivers were almost obese.

The results of discomfort for each part of body ordered by severity are shown in Figures 1-3.

Figures 1-3 go here

Moreover, 6.3% of drivers had one accident; the same proportion of drivers had musculoskeletal surgery while 18.4% of drivers had a vertebral disc surgery. 1.1% of drivers were alcoholic and 38.9% of drivers smoked. 20% had digestive discomforts whereas 50.5% had chronic back pain. 42.1% of drivers claimed they had regular exercises. The career history showed that 96.5% of drivers had had the same job. 52.6% of drivers were working with heavy vehicle. 13.7% of drivers worked more than half of day each day.

The results of the relationship between anthropometric dimensions and MSDs are shown in Table 2. These results were derived from Spearman coefficient of correlation in test.

Table 2 goes here.

If r is positive, it means that the relationship is direct; and if r is negative, then the relationship is reverse. e.g.: The relationship between the variables of age and neck pain is straight. (P-value <0.05, $r=0.176$)

We investigated the associations between MSDs and the related factors such as previous job, working hours, regular exercise, and back pain, surgery and accident history. Those drivers who worked more than half of day had disorders in their hands, wrists and forearm. (P-value<0.05) Those who didn't exercise regularly had more disorders in their hands, fingers, knees, legs, and wrists (P-value <0.05) The drivers who had chronic back pain, felt discomforts in neck, low back, knees and ankles. Those drivers who had a vertebral disc surgery complained about discomforts in their pelvis. The drivers who had at least one accident in their driving history had discomforts in their thigh. The relationships between body's dimensions and MSDs are shown in Table 3.

Table 3 goes here.

Discussion

A similar study in Sabzevar found relationships between that weight and scoliosis amongst truck drivers. [16] The author also reported associations between position of driving seat and disorders

in pelvis and back pain. Our findings were consistent results with the results of this study; in addition, we found that these disorders also were associated to anthropometric parameters. . Reviewing some similar studies revealed inconsistent results. For instance, Krause and colleagues [17] did not report links between age, weight and back and neck pain; where as, in another study, there was a significant relationship between weight and back pain. [18]. Bigos and colleagues [19] did not find relationships between weight and back pain. Similarly, Anderson [20] did not report relationships between age and back pain. Similar to other studies which reported relationships between length of working and neck and back, our study found that some disorders were statistically associated with working hours.. This study also found links between MSDs and other related factors such as previous career, the working duration, regular exercise, back pain, spinal surgery and accident. Furthermore, we discovered that the prevalence of discomforts of knee was relatively high among drivers whose previous job was not driving. What is more, working hours appeared to be associated with the discomforts in forearm, wrist, hand and fingers, particularly among drivers who worked longer than a half day.

. Those drivers who did not exercise regularly had discomforts in their hands, fingers, knees, legs and ankles. Those who had chronic back pain suffered from neck pain and disorders in knees, ankles and thighs. The drivers, who had MSDs surgery, had pain in their pelvis. Those drivers, who had a spinal surgery, had disorders in their forearms. The drivers, who had an accident in the past, suffered from disorders in their thigh. Individual lifestyle and working and disease history related to MSDs are shown in Table 4.

Table 4 goes here.

The findings of this study suggested the following considerations for hiring new drivers: They should be young, tall and fit and healthy. This approach would be an effective way which decreases MSDs among public vehicle drivers. We suggest that drivers avoid long working hours, especially, those who had a spinal surgery or back pain. Drivers should exercise regularly. We can also prevent MSDs and back pain by following techniques: correct postures during driving, reviving and periodical break, regular exercise, even a short walk, and getting in shape by losing weight for overweight people. We also recommend extending anthropometry for all drivers. By that we will be able to design more suitable seats, so the drivers can drive correctly and not suffering from inappropriate postures in driving.

Conclusion

This study showed that drivers' MSDs are related to their height, weight and age. In other words, the high weight and age increases the probability of MSDs; while the height of drivers appeared to be negatively associated. It seems reaching the steering wheel results in back and neck pain; therefore, taller individuals spend lower energy in their body for reaching to steering wheel. Finally, it is better; we select those who are tall, young, fit and healthy for driving jobs.

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Conflict of Interest: The authors declare that there is no conflict of interests

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Table1: Anthropometric Statistics

Variable	Minimum	Maximum	Average (standard deviation)
Height	160	186	172.0376 (6.3471)
weight	52	106	76.5684(13.0471)
Upper limb length	79	100	90.4947(3.7640)
Arm length	75	100	85.6105(5.4972)
Popliteal length	40	57	47.2316(3.6275)
Popliteal height	40	48	43.2316(1.9649)
knee length	53	67	59.9368(3.4666)
knee height	40	60	54.0526(2.7536)
Body Mass Index	17.87	33.46	25.8490(4.0172)

Table 2: The relationships between anthropometric dimensions and age with MSDs (Spearmen test results)

Anthropometric Parameters								
Discomforts in:		**Height**	**weight**	**Upper limb length**	**Popliteal length**	**Knee length**	**BMI**	**Age**
Neck	r		**0.245				**0.248	*0.176
	p		0.008				0.008	0.044
Shoulders	r		*o.170			*0.207		
	p		0.050			0.022		
Upper back	r				*-0.216			
	p				0.018			
Arm	r	*-0.184		*-0.228			*0.210	
	p	0.037		0.013			0.020	
Elbow	r	*-0.256		**-0.316			*0.223	
	p	0.006		0.001			0.015	

Low back	r		*-0.215	*0.209
	p		0.018	0.021
Buttock	r	*0.173		
	p	0.047		
Thigh	r	**0.291		**0.297
	p	0.002		0.002
Knee	r		*-0.170	
	p		0.049	
Leg	r	***0.173**	*-0.170	***0.203**
	p	**0.047**	0.050	**0.024**
Ankle	r			***0.223**
	p			**0.015**

Table 3: The associations between body dimensions and MSDs

Anthropometric indices	**Disorder increasing**
↑ Weight	Neck, Shoulder, Buttock, Thigh, Leg
↑ BMI	Neck, Upper arm, Elbow, Thigh, Leg, Ankle
↑ Knee height	Shoulder
↓ Height	Upper arm, Elbow
↓ Popliteal length	Upper / Low back, Knee, Leg
↓ Sitting height	Upper arm, Elbow

Table 4: The associations between personal backgrounds & habits on MSDs

Agent: Drivers who	Effect: Discomforts in
have working history in driving	knee
drive more than half of day	wrist, hand and fingers
don't exercise regularly	hand, fingers, knee, leg, ankle
have had back pain	neck and spinal column
have had a spinal column surgery	pelvis and forearm
have had an accident	thigh
Age and working history	neck and lower back

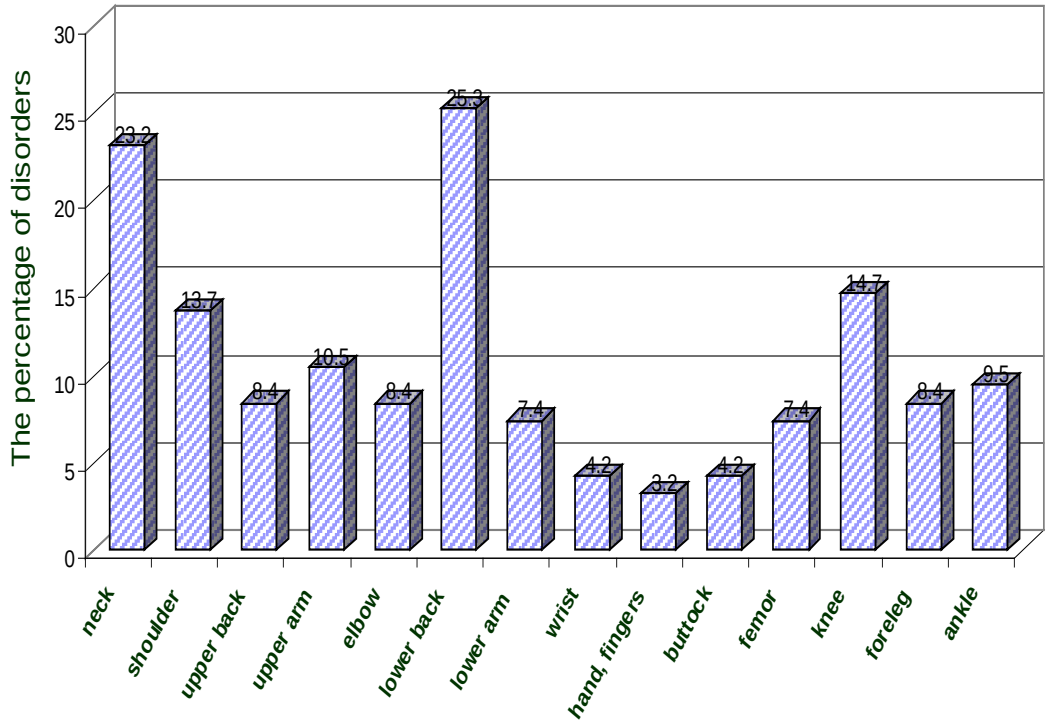

Figure 1: Distribution of Mild MSDs among drivers

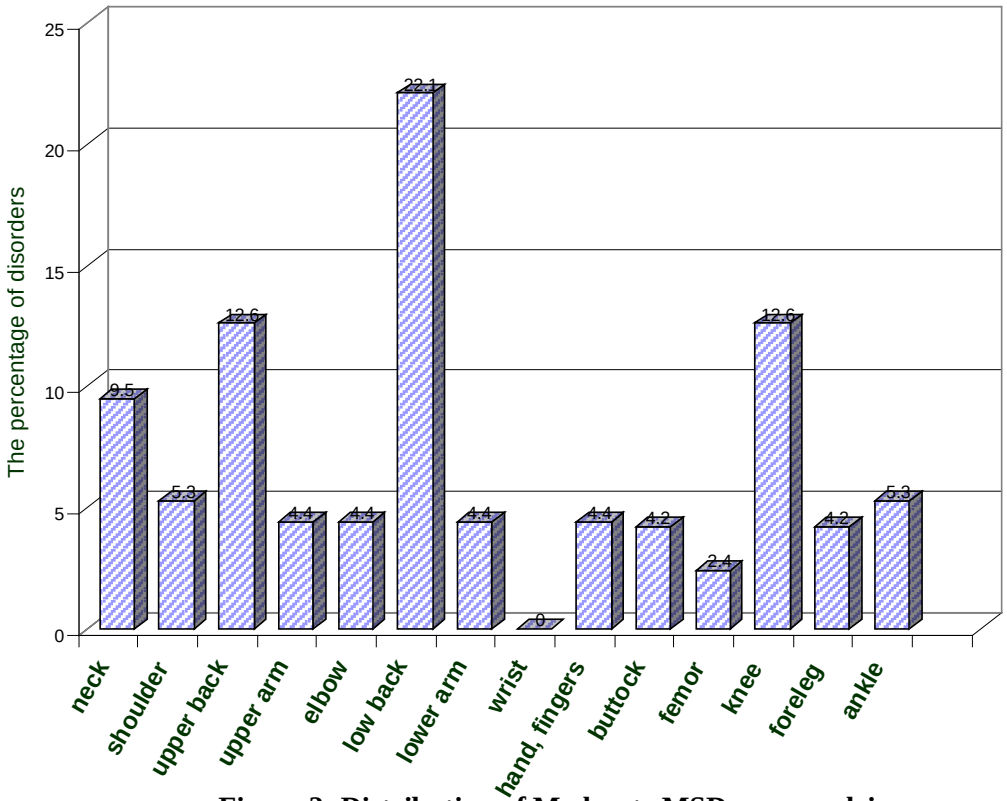

Figure 2: Distribution of Moderate MSDs among drivers

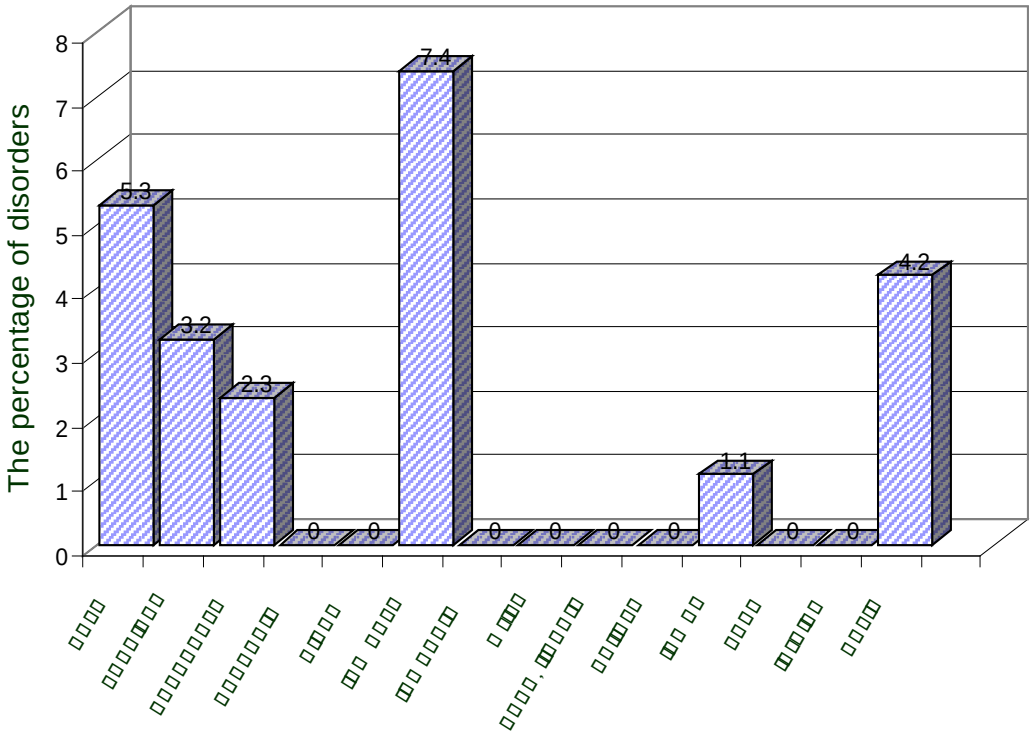

Figure 3: Distribution of Severe MSDs among drivers