

Relationship between Low Back Pain and Types of Office, Home and Car Seats in Sultan Qaboos University Staff

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Abstract Objectives: The aim of this investigation was to study the prevalence of low back pain (LBP) and its relationship to chair designs and sitting postures in Sultan Qaboos University (SQU). **Methods:** A cross-sectional survey using a standardized questionnaire with established reliability and validity. The questionnaire sought information on social and demographic characteristics, history of LBP, its duration, number of hours spent sitting in office, car and at home, job type, severity of LBP, factors predisposing to LBP and types of treatment used. All participants of study were consented using a signed and attended consent form. **Results:** Three hundred subjects, 174 males and 126 females aged 20 - 60 years participated in the study. The prevalence of LBP among SQU staff was 44.7% of whom 68% had LBP for ≥ 1 year and 66% had LBP for < 1 year. Those who had LBP for ≥ 1 year were mostly below 50 years of age. **Conclusion:** It was found that the prevalence of LBP in SQU was higher among doctors (50.0%), technicians (48.1%) and administrators (46.9%) than in teachers (42.9%) and manual workers (22.2%). The study also showed a significant relationship between the duration of sitting in home chairs and LBP.

Keywords: low back pain, duration, office chairs, home chairs, car seats, back and arm support, sitting position

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1. Introduction

Sitting is something reflects the art between the bony skeleton and other soft tissue like muscles and ligaments, and these all controlled by nerve structures and higher brain function.

When the person exceeds the normal and healthy time of sitting, the body will react adversely by producing and accumulating toxin product which are yelled from restriction of the oxygen and other nutritional elements to the important organs of the body like muscles and cartilages which are important in sustain different kinds of sitting and postures.

Low back pain can sometimes begin without warning due to the fact that discs and cartilage do not have nerve supply. LBP is a constellation of symptoms that is usually acute and self-limiting. However, prolongation of such pain leads to chronic low LBP, the cause of which can be iatrogenic in many instances. [1] Low back pain is the most reported disease because the low back supports most weight of the human body when sitting or standing, and the majority of the muscular activities take place in this region. Prolonged sitting, wrong posture and wrong

handling of heavy objects were considered as the most common risk factors contributing to the LBP. It ranks as the second main medical cause of adults' visits to physicians, third cause for surgery among chronic disorders and fifth for frequent hospitalization. [2,3] Until the middle of the Nineteenth century, workers stood on the job. In the current technological world of computers and automation in the race to increase productivity, most of the work is done in offices sitting behind desks and watching production lines. The types of jobs, duration of sitting on office chairs and work habits have therefore changed with technology [4]. In the United States, the cost of medical and disability caused by LBP increased from \$11 billion in 1986 to \$20 billion in 1991. [5,6] This cost is three times as much as that of HIV/AIDS and lung cancer combined. [7]

Today professional office workers spend about 70 % of their time sitting in their offices, usually for 45 minutes at a stretch. Deskbound workers including telephone operators, telemarketers and data entry workers spend nearly 100% of their working time sitting. [8] In addition, people also spend a lot of time in their cars commuting to work as well as sitting for long hours at home in front of TV screens and home computers. Fifty percent of drivers in US were found to suffer from LBP due to unhealthy sitting for long hours. [9]

Some chair's designs are considered as the main cause of activity limitations among office workers. [2,3] Switching of chairs with different shapes and designs was found to have a positive impact on the level of the LBP as well as reducing the discomfort level. On the other hand, prolonged sitting on the same chair during working hours or watching TV at home plays a major role in LBP due to continuous pressure on the same body parts. [10] The cost of the treatment of LBP due to unhealthy sitting was found to have a negative impact on work productivity as well as in financial costs due to lost working hours and treatments. Although there are a lot of campaigns and advertisements in the society going on to deliver good massages about the health and safety in sitting office or home with other exercises to reduce muscle spasms and sitting problems, the numbers of cases of LBP are increasing. Several disability scales have been developed for people with LBP, the two most commonly used Roland-Morris Disability Scale and the Oswestry Low Back Pain Disability Questionnaire (OSW). [11] Greater discomfort level is reflected by a higher score on the scale. These scales are used as measures of treatment outcome in people with LBP in clinical trials. [12] According to a study done in the Netherlands. [13] Office chairs are categorized into three categories:

Chairs with a fixed seat and back rest, Dynamic chairs with a seat and back rest movable in a fixed ratio with respect to each other and Dynamic chairs with a freely movable seat and back rest.

Generally, chairs must fit users' anthropometrics measurements in order to prevent the discomfort while sitting. Ergonomic chairs should include special characters which provide the human body to be freely adjusted without any functional compromising and complications, so the users can do their tasks without any difficulties, the following are some features:

Adjustable backrest that allows the lumbar support fits in the user's lumbar curve. Backrest-angle adjustability also allows the sitter to increase the angle between torso and thighs and reducing pressure on discs by restoring lordosis. [8]

Lumbar support which is designed to provide support and to reduce the force that applied to the lower back muscles by taking off some of the weight on the back during prolonged sitting. Cushioned (suspension) seat pan that eliminate soreness and reduce pressure by distributing body weight. Using the cushioned seat with rounded edge is important to maintain the vascularity of the lower limbs.

Adjustable armrests are designed for different heights for computer use to reduce the load on the lumbar region. This also supports the arms, so reducing the work of shoulders and the upper arms. In addition, adjustable seat heights with supportive footrest provide easy mobility during sitting. [8]

During driving for long distances or sitting in office for long periods of time leads to discomfort which increases with time. Despite the importance of the adjustable features and the control mechanisms, users do not read manuals to learn about chair adjustment and the control mechanisms. Helander et al. [14] conducted three experiments and found that car users spend very little time identifying the adjustable features and control mechanisms, and some features and controls were unused. They also found that adjustable features were frequently not used and some

users thought that adjustable features were not important. They concluded that users need education and training before using ergonomic chairs and chairs should be designed in a style to make adjustable features and controls easy to locate.

Types of tasks done while sitting in office chairs are commonly found to cause work-related musculoskeletal injuries including LBP. Other researchers found that the position and changes in trunk posture and increases in back muscle activity were significantly affected by work tasks but not the types of chairs. [13] Previous research in large cohorts showed that most of the pain was in the lower back followed by neck and thighs. [15]

In addition, a correlation found between sitting time and discomfort level concluding that discomfort level was related to the accumulation of fatigue during the workday sitting. [16]

In United Arab Emirates, the prevalence of LBP was estimated to be about 57% in males and 64% in females. [17]

Previous research showed that 80% of people have suffered from LBP in their lifetime. Chair designs and the wrong sitting positions were found to be responsible for about 50% of the LBP. [18]

Recurrences of LBP are also common, with the percentage of subsequent LBP episodes ranging from 20% to 44% within 1 year for working populations to lifetime recurrences of up to 85%. [19] Recent studies suggested that, 25% of individuals who have LBP in a primary care setting may suffer for more than one year. [3,20]

A previous study done in a hospital in Abuja has shown that, nurses were at higher risk of getting LBP for a long duration compared to other staff. [21]

Our aim is: to study the role of office, car and home chairs designs, and duration of use on the prevalence of low back pain in SQU staff.

2. Materials and Methods

This was a cross-sectional study based on a questionnaire distributed to the staff of SQU, Muscat, Oman. Participants' age, weight and height were obtained by the observer using a standard weighing and height scale at the place of work. The questionnaire was administered to 300 SQU employees between October 2012 and December 2012. The study was granted ethical approval by Research and Ethics Committee of College of Medicine and Health Sciences, Sultan Qaboos University. All participants of this study were consented using an explained signed consent form.

A validated questionnaire "Acute Low Back Pain Screening Questionnaire" [22] was used in this study. Minor changes in the questions were made to suit Omanis and other GCC citizens.

The questionnaire included 15 questions, 4 of them were photo-based questions. In addition to personal demographic information, the questionnaire also targeted information on: age History of LBP and its duration, number of hours spent sitting in office, car and home chairs, types jobs predisposing to LBP, severity of LBP using a scale (1-10 pain scale), and treatment of LBP as well as knowledge about causes of its prevention. Six sitting posture images were attached to enable participant

to select the image of sitting that they commonly adopt. The T Pictures of different types of chairs marketed in Oman were also attached to the questionnaire. The height of each chair, the presence of back support and the degree of angle between the back support and the base of the chair were marked clearly.

Each chair type had an ID number. The participant selected the picture of the chair that they used in office, car and home. Office chairs were categorized according to the study done in Netherlands into 3 different categories. [23]

3. Data Analysis

Data collected was analyzed using the Chi-square and Binary Logistic tests of the SPSS (version 19). The correlation between LBP, gender, age, BMI, and time of sitting on office, car and home chairs was evaluated.

4. Results

Table 1 shows the socio-demographic characteristics of subjects. Three hundred Sultan Qaboos University staff completed the questionnaire. They were 20 to 60 years of age with a mean BMI of 26.1 (± 5.7). One hundred seventy-four (58.0%) were males and 126 (42.0%) were females. One hundred thirty-three (44.3%) were teachers (including demonstrators and professors), 96 (32.0%) were administrators, 52 (17.3%) were technical staff and 10 (3.3%) were doctors and 9 (3.0%) were manual workers.

Table 1. Socio-demographic characteristics of the subjects*

Location	Sultan Qaboos University		
Age**	20 – 60 years		
BMI .Kg/m ²	26.1 (± 5.7)		
Comparison	LBP	NO LBP	Total
Males	82(47.12%)	82(47.12%)	174 (58.0%)
Females	52(41.27%)	52(41.27%)	126 (42.0%)
Teachers	57 (42.9%)	57 (42.9%)	133 (44.3%)
Administrators	45 (46.9%)	45 (46.9%)	96 (32.0%)
Technicians	25 (48.1%)	25 (48.1%)	52 (17.3%)
Doctors	5 (50.0%)	5 (50.0%)	10 (3.3%)
Manual Workers	2 (22.2%)	2 (22.2%)	9 (3.0%)

*Data are presented as means (±SD) and (%)

**Age in groups.

Subjects with LBP were classified into two groups: those who had LBP for a year and more and those with less than a year. Sixty-eight (51%) out of total 134 subjects had LBP for ≥ 1year and 66 (49%) of them had LBP for < 1year. Forty-three (52%) of the males had LBP

for <1year and 39 (48%) of them had LBP for ≥ 1year, while 23 (44%) of the females had LBP for <1year and 29 (56%) of them had LBP for ≥1year.

The prevalence of LBP among SQU staff was 134 (44.7%). Of the 174 male subjects participating in this study, 82 males (47.12%) had LBP compared to 52 females (41.27%) out of total 126 female subjects. The prevalence of LBP was higher amongst doctors, technicians and administrators than in teachers and manual workers, but this difference was not statistically significant. Low back pain was reported as the first complaint (44.7%) followed by legs pain (9.0%) then by upper back pain (8.7%). Sixteen percent of subjects suffered from pain in their upper back, lower back and legs at least once in their life.

Low back pain was more prevalent among younger age group. Around 83% with LBP were at the age of 50 years or less, while 17% were more than 50 years of age. This difference was not statistically significant. The prevalence of LBP was 48.5% among those who had BMI < or equal 25 kg/m² compared to 51.1% among those who had BMI > 25Kg/ m². This difference between LBP and the BMI in this study was not statistically significant.

Table 2 shows the effects of age on LBP duration. Those at age of 50 year and below had more LBP. Within the group who showed LBP for ≥ 1 year, 50 of them were below 50 years of age and only 18 of them above 50 years of age. Chi-square analysis showed that this difference was statistically significant (P ≤ 0.04).

Table 2. The relationship between low back pain duration and age group

		age in years		Total	P value
		≤50	>50		
pain duration	<1y	61 92.4%	5 7.6%	66	<0.04
	≥1y	50 73.5%	18 26.5%	68	
Total		111 82.8%	23 17.2%	134 100.0%	

Table 3 shows the relationship between LBP duration and the type of office chairs. From the 68 subjects who had LBP for ≥ 1 year, 16 subjects used dynamic freely mobile chair with arm support, 35 subjects used dynamic chair with fixed ratio and arm support and 17 subjects used fixed chair with arm support and pelvic support. Seventeen subjects out of a total 66 who had LBP for < 1 year used dynamic freely mobile chairs with arm support whereas 43 subjects used dynamic chairs with fixed ratio and arm support. The remaining 6 subjects used fixed chairs with arm support and pelvic support. The relationship between LBP duration and the type of office chairs was statistically significant (P < 0.048).

Table 3. Relationship between LBP duration and office chair types

Office chair type	LBP ≥ 1year	LBP < 1year	Total	P value
Dynamic freely mobile + arm support	16 (23.5%)	17(25.8%)	33	
Dynamic with fixed ratio + arm support	35(51.5%)	43(65.2%)	78	
Fixed with arm support + pelvic support	17(25.0%)	6(9.1%)	23	
Total	68	66	134	0.048

Thirty-four respondents with LBP (25.4%) used extra back support in their office chairs to reduce the severity of LBP, while 100 (74.6%) subjects with LBP never used extra back support in their office chairs. The relationship between LBP and the use of extra back support in office chairs was not statistically significant.

It can be seen that there was a higher prevalence of LBP among drivers using mobile seat without pelvic support (85.8%) than in passengers using mobile seat with pelvic support (14.2%). Chi square analysis revealed no significant relationship between car seats for LBP.

Eighty-nine subjects (66.4%) with LBP used sofa chairs at home, 25 subjects (18.7%) used single fixed chairs without pelvic support and 20 subjects (14.9%) used Arabic classic sitting in their homes.

Seventy-Four (55.2%) who sat in a reclined sitting posture had a higher prevalence of LBP than those who sat with crossing legs sitting posture 60 (44.8%). Most subjects who had LBP for ≥ 1 year sat in the reclined position, while those who had LBP < 1 year tended to cross their legs. The relation between LBP and the sitting posture was not statistically significant.

Ninety-nine respondents (76.0%) with LBP spent about 3-7 hours sitting in their office chair and 17 (13.3%) spent about 8-14 hours. Sixteen individuals (10.0%) with LBP spent about 1-2 hours and only 1 (0.7%) subject with LBP spent more than 15 hours sitting in office.

Table 4 shows the relationship between the severity of LBP and daily home sitting. Fifty-eight subjects (74.4%) with severe LBP spent 2 hours or more sitting in home chairs in front of TV screens, computer or relaxing and 20 subjects (25.6%) spent < 2 hours sitting in home chairs. Sixteen respondents (56.7%) with moderate LBP spent < 2 hours and 13 (43.3%) with moderate LBP spent 2 hours or more. Chi square analysis showed a significant relationship between the duration of sitting in home chairs and LBP ($P < 0.002$).

Table 4. Relationship between severity of LBP and daily home sitting (in hours)

Daily home sitting (in hour)	Moderate LBP	Severe LBP	P value
$\geq 2h$	13 (43.3%)	58 (74.4%)	
$< 2h$	16 (56.7%)	20 (25.6%)	< 0.002
Total	30 (100%)	78 (100.0%)	

Eighty-three respondents (61.9%) with LBP spent 1 hour or more sitting in cars daily and 51 of subjects 38.1% with LBP spent < 1 hour. The relationship between LBP and time of sitting in car seat was not statically significant.

Using the pain rate scale from 1-10, Fifty-six percent had pain rate more than the median (median =3) and 35% had pain rate less than the median. The difference in pain severity was statistically significant ($P = 0.03$). Thirty percent of people had LBP less than one month duration, 19.5% had LBP from 2 to 12 months and 50.7% had LBP more than a year.

Eighty-nine subjects with LBP took some rest to relive their pain without the need for medication. Seventy-eight subjects with severe LBP used both drugs and physiotherapy treatment for their pain. Fifty-two of subjects without LBP used some treatment to prevent the pain. The relationship

between severity of LBP and treatments received was statistically significant ($P < 0.01$).

5. Discussion

This study aimed to evaluate the prevalence, severity and duration of LBP in relation to the use of office, home and car chairs in SQU staff using a validated questionnaire. The study focused on LBP in relation to gender, age, BMI, types of chairs and duration of sitting in office, home and cars.

The prevalence of LBP among SQU staff was 44.7%. In this study, the prevalence of LBP was higher among men than women. Some studies have reported opposite trend [24] and others have shown no gender differences. [25] A Study done in UAE showed that the prevalence of LBP was higher in women than in men. [17]

It has been suggested that the prevalence of LBP amongst younger age groups is lower than amongst older age groups. From this study, we have found that subjects at the age of 50 year and below had significantly more LBP than those who were over 50 years. This might be due to the fact that most of subjects in the younger age group started to work at SQU as their first job till now and were using desks and computers and were also probably using the same type of chair for the last 25 years. Older subjects were probably using different jobs before 1986. As other studies showed that the variation in job types between different places may have a role in the lower prevalence of LBP due to the variation in the types of chairs used in different jobs. [21,26] Another study showed no relationship between age and severity of LBP. [21]

In this study, the prevalence of LBP was higher amongst obese subjects than in non-obese subjects. This may be due to increase in weight and pressure added to the lower back which affects the normal spine curvature. [27]

In the present study, the prevalence of LBP was higher amongst doctors, technicians and administrators than in teachers and manual workers. This might be explained by the fact that most of the work done by doctors and teachers took place in an office setting which is considered as a risk factor for LBP. Manual workers spent less time sitting and their works depend mostly on movement which may strengthen their back muscles and this may reduce their risk of developing LBP. A previous study showed that the prevalence of LBP was highest among nurses followed by administrators and cleaners. [21] Some studies associated LBP with heavy physical work, bending, poor posture and prolonged sitting or standing. [28]

In this study, most of subjects with LBP spent about 3-7 hours sitting in their office chairs. Our study focussed on three office chair categories. The prevalence of LBP was higher in subjects using dynamic chairs with fixed ratio between the base and the back of the chair than those using fixed chair with back and pelvic support. Also, the study results showed a significant relationship between LBP duration and the use of dynamic chairs with fixed arm supports ratio. This is because subjects sitting on those types of chairs which had no back support sat in

unhealthy posture that affected their lumbar spine. Subjects who used fixed chairs with pelvic support had less LBP because those types of chairs helped to stabilize the lumbar spine and prevent harmful movements. The findings of this study do not corroborate with results of study done in Netherlands which concluded that dynamic chairs offer a potential advantage over fixed chairs. [13] The difference in findings may be due to the fact that many of the dynamic chairs used at SQU are not used in the proper way and the chairs were manufactured for Western people who are much taller than Omanis and other Gulf people.

In this study, the use of extra back support did not reduce LBP despite to the fact that office chairs with extra lumbar or pelvic support cause relaxation of lower back muscles and can fill the space that exists between the lower back and the seat. [8]

The present study showed no relation between LBP and extra back support while other studies showed a significant relationship between LBP reduction and extra back support. [29]

In the present study, most subjects with LBP spent ≥ 1 hour driving every day. The relationship between LBP and time of sitting in car seat was not statically significant.

In this study, as other studies done in US showed that there was a higher prevalence of LBP among drivers using mobile seat without pelvic support than in passengers using mobile seat with pelvic support. [9]

In this study, most of subjects with LBP spent ≥ 2 hours sitting in home chairs in front of TV screens, computer or relaxing. The study showed a significant relationship between the duration of sitting in home chairs and LBP. Our findings correlate with findings of a previous research. [21] The explanation for these findings is that, the skin and other tissues (muscle, nerve and blood vessels) of the lower back need continuous blood flow to stay healthy and function normally. Too much external pressure for long periods during prolong sitting time can reduce blood flow and cause other types of tissue damage, ranging from wringing fluids out of cells to impeding the transmission of nerve signals. [8]

In the present study, the prevalence of LBP was higher in subjects who used sofa chairs at home than those used single fixed chairs without pelvic support. The lowest prevalence of LBP was recorded between those who used Arabic classic sitting in their homes.

In our study we found that subjects with a reclined sitting posture had a higher prevalence of LBP than those who sat with crossing legs sitting posture. In this study, some subjects reported that they have changed their chair types more than once.

Using the pain rate scale from 1-10, the mean pain score was 3. In the present study, most people with LBP had pain score of more than 3. Two percent of subjects with LBP have already undergone a surgical operation to treat their severe LBP. This is because the lower back is the site for support to the body in the sitting and standing positions. Prolonged sitting can lead to muscle injury or even tear of the ligaments which in turn lead to cause severe LBP and disabling consequences. Strenuous activity and wrong seating posture may cause disc tear or disc herniation resulting in nerve compression increasing the severity of LBP. Muscle tension at the back of the

neck may increase as much as 50 percent when a person changes from an upright to a slumped sitting posture. [8]

In this study, 78 subjects with severe LBP used both drugs and physiotherapy treatment for their pain and 89 (43.6 %) subjects with LBP took some rest to relieve their pain without the need for medications. Other studies concluded that acute LBP may not be relieved by bed rest. [21] In this study, some subjects mentioned that they started to park their cars far away from their offices and walking to reduce the severity of LBP.

People vary in their weight and height. If given the correct information chair manufactures may be able to come up with chair designs that suit the physical makeup of the Omani and GCC people.

6. Limitations

The main limitation of the current study was the cross-sectional nature of the data collected.

In the present study, responders have to select only a single sitting position, while position may vary from time to time. A larger sample size is required for such cross-sectional research.

7. Future Directions

Health education on posture and the best types of office, car and home seats should be introduced in the workplace to reduce the burden of LBP to the patient and to health authorities. Future researches should focus on expanding this study to a spectrum of local manufacturers to help design better chairs and advice on their optimum use.

8. Conclusions

It was concluded that LBP is a common complaint among SQU staffs with higher prevalence in males than in females and was more prevalent among subjects ≤ 50 years old. Most subjects with chronic LBP used dynamic chairs with fixed ratio as compared to those using fixed chairs with pelvic support. In the present study, there was a significant relationship between LBP duration and the types of office, car and home chairs. The prevalence of LBP was highest in subjects using dynamic office chairs with fixed ratio between the base and the back of the chair.

Advances in Knowledge

1. The study determined the prevalence of LBP in Sultan Qaboos University staff.
2. It studied the relationship between LBP and types of chairs used in office, home and cars.
3. Results of this article will increase awareness of all office employees in Oman and elsewhere about LBP and its relationship to sitting positions at office, home and cars.
4. No previous study in Oman and other Gulf countries has studied the relationship of LBP in relation to sitting positions at work, home and in cars.

Application to Patient Care

1. This study will alert healthcare providers on the importance of sitting posture as a probable main cause of LBP caused by types of office, car and home seats.
2. Study will encourage future researches and office, car, home chair manufactures to customize their products to suit the stature of Omanis and other nations in the region.

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