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Research Article

PREVALENCE, ERGONOMICS, SOCIODEMOGRAPHIC CORRELATES WITH MUSCULOSKELETAL INJURIES AMONG SONOGRAPHERS IN RIYADH, KSA

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ABSTRACT

This study was conducted to explore the prevalence of musculoskeletal injuries (MSI) among Sonographers in Riyadh. The main objective of the study was to investigate the relationship of ergonomics and sociodemographic correlates with musculoskeletal injuries (MSI) among Sonographers. The sample of this study comprised of (n=153) sonographers of Riyadh. Ergonomics, sociodemographic variables and occurrence of MSI was measured by administering self-reported survey form. Survey was conducted by visits to hospitals as well as by using electronic survey via email. Sociodemographic variables of age (r=.208, p<.01), gender (r=.246, p<.01) and work experience (r=.191, p<.05) were found positively, whereas health status (r=-.230, p<.01) exercise frequency (r=.301, p<.01), amount of sleep (r=.225, p<.01) and perceived socioeconomic status (r=.183, p<.05) was found negatively correlated with MSI. The findings of this study would contribute to reduce the occurrence of MSI by proposing effective strategies for safe working settings as well as strategies for achieving healthy life style and to enhance the performance of sonographers.

Keywords*: Musculoskeletal Injuries, Sonographers, Prevalence, Ergonomics, Sociodemographic Correlates*

INTRODUCTION

Musculoskeletal injury (MSI), has been demarcated as any damage of muscular or skeletal systems that is due to persistent activities (Hootman *et al*., 2002). In the field of Occupational Health and Safety Regulation it has been identified as "an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue including a sprain, strain and inflammation, that may be caused or aggravated by work" (Work Safe BC, 2008, p.1).

On worldwide level, there is an increase in the incidence of work related musculoskeletal injuries/disorder among sonographers (Muneer *et al*., 2017; Baker and Coffin, 2013; Evans *et al*., 2009). 76% injures accrued in shoulders and the rest of the injures accrued in neck, waist, back and hands (Baker and Coffin, 2013). There are multi reasons for these injuries which require multiple solutions for justifying injury risk. Sonographers' work postures, work schedules, task rotation, administrative support, ergonomic and workplace equipment all these are essential factors for reducing the occurrence of these disorders (Work Safe BC, 2008, p.15).

Furthermore, demographic characteristic such as age, gender and lack of exercise can be some of the risk factor for the Sonographers (Harrison and Harris, 2015). Senior workers tend to migrate out of the

stressful work environment, in addition females show higher risk to have musculoskeletal injuries (Village and Trask, 2007).

Unfortunately, the majority of the sonographer accept that the musculoskeletal discomfort is a part of their work and it is very common among sonographers to handle such situations in their own without reporting it (Roll *et al*., 2014). These injuries have a financial and emotional impact on the workers and affect workplace productivity and quality patient care. Statistic shows that the cost effect of the musculoskeletal injuries can be more than $180,000 (Muir *et al*., 2004).

To explore the prevalence of MSI two research question raised, "What is the prevalence of musculoskeletal injuries (MSI) among Sonographers in Riyadh?" and "What is the relationship of Ergonomics and sociodemographic correlates with musculoskeletal injuries (MSI) among Sonographers in Riyadh?" Keeping in view of previous literature hypothesis was formulated, **"**there will be significant relationship of Ergonomics and sociodemographic correlates with musculoskeletal injuries (MSI) among Sonographers in Riyadh."

MATERIALS AND METHODS

This study has correlation design. It was conducted during 1437-1438H / May, 2016-April, 2017 in Riyadh to explore the prevalence of MSI as well as to investigate the relationship of ergonomics and sociodemographic variables with MSI among Sonographers.

The sample of this study was comprised of (n=153) sonographers of Riyadh. Sonographers having age range of 21-53 years (31.45±7.26, M±SD) were included. Participants were recruited through purposive sampling from 14 hospitals of Riyadh. Participant were approached in governmental as well as private sector. Qualified Sonographer appointed at various hospital were included. Minimum work experience was six (6) month. The tenure of 6 months was considered to avoid adjustment problem.

Researchers prepared survey forms. This form was having various section. Initial section was consistent of sociodemographic Information to determine the age, gender, qualification, work experience, marital status, family structure, and perception of socioeconomic status. Health related data, fitness and sleeping habits was arranged in next section. Third section was having question related with MSI. Fourth part was having Information related with treatment option.

All the ethical considerations were fulfilled before conducting the study. Ethical approval from the Departmental scientific sub-committee and Research Ethical committee of College of Health and Rehabilitation Sciences, Princes Nourah bint Abdulrahman University was sought. Before approaching participants, a letter explain purpose of study was sent to hospital administration for getting permission. Consent form was given to the subjects to get their willingness to participate in the study and to gather demographic information. Participants were assured about confidentiality of their information. Data was collected by using both means of individual administration and by online survey forms.

Collected data was analyzed by using SPSS (V. 24). Descriptive Statistics of measures of central tendency and dispersion was calculated. Pearson's Product Moment Coefficient of Correlation was used to measure the relationship between ergonomics, demographic correlates and musculoskeletal injuries (MSI) among Sonographers.

RESULTS AND DISCUSSION

Results

In this study, total 250 survey forms were distributed and 170 filled forms were received to research team. Out of 170 survey forms 17 were discarded due to incomplete information. Thus, results were based on 153 (males =33 and female =120) sonographers.

Table 1: Sociodemographic characteristics of Sonographers (N=153)

Characteristics	*f*	%	*M*	*SD*
Gender				
Male	33	22%		
Female	120	78%		
Marital status				
Unmarried	76	50%		
Married	74	48%		
Other	3	2%		
Perceived Socioeconomic Status				
Lower	3	2%		
Lower Middle	12	8%		
Middle	95	62%		
Upper Middle	33	22%		
Upper	10	7%		
Work Experience				
1-5 years	78	50.98%		
6-10 years	39	25.49%		
11-15 years	24	15.68%	6.82	5.41
16-20 years	11	7.1%		
More than 25 years	1	0.65%		

Table (1) is showing that almost half of the respondents were currently unmarried 76 (50%); 74 were married (48%), and 3 were widows or divorced (3%). Most of the respondents perceived their socioeconomic status as middle class (n=95, 62%), 33 respondents (22%) reported as upper middle, 12 as lower middle socioeconomic class (8%), 10 (7%) as upper and 3 (2%) as lower socioeconomic class. As far as work experience is concerned, 78 (51%) sonographers reported 1-5 years, 39 (25%) respondents were working from 6-10 years, 24 (16%) correspond to 11-15 years, 11 (7%) stated 16-20 years and only 1 sonographer was having work experience of 25 year.

Table 2: Comparison of MSI and occurrence of MSI on the variable of work experience

Work experience		Group					
		M	SD	N	95% CI for Mean Difference	t	df
MSI	1-10 years	.34	.476	117			
	More than 10 years	.50	.507	36	-.340, .024	1.715	151
Occurrence during last two years	1-10 years	.41	.659	117			
	More than 10 years	.72	.849	36	-.578, -.046	2.025*	151

p> .05

Results (table 2) are presenting comparison among work experience. Two categories were made as 1-10 years of work experience and more than 10 years of work. Significant difference had been found between two groups of work experience people (t=2.025, df=151) on MSI occurrences. Mean score is higher for occurrence of MSI during past two years among those sonographers who have work experience more than 10 years.

Table 3: Health related characteristic, problem and MSI of Sonographers (N=153)

Variable	*f*	%
Perception of own Health		
Poor	0	0%
Fair	13	8.5%
Good	90	58.8%
Very good	38	24.8%
Excellent	12	7.8%
Health status compare to others		
Much below	2	1.3%
Below average	22	14.4%
Average	18	11.8%
Above Average	88	57.5%
Much Above	23	15%
Comparison of Health Status to past 5 years		
Much worse	1	0.7%
Worse	31	20.3%
Same	81	52.9%
Better	35	22.9%
Much Better	5	3.3%
Frequency of Physical Activity		
Every day	79	51.6 %
3-4 times a week	29	19%
once a week	21	13.7%
1-3 times a month	10	6.5%
less or never	14	9.2%
Average Sleep		
4-5 hours	16	10.5%
5-6 hours	42	27.5%
6-7 hours	50	32.7%
7-8 hours	34	22.2%
More than 8 hours	11	7.2%
Health issue		
No	128	83.7%
Yes, and medical consultation	25	16.3%
Happening of MSI		
No	95	62.1%
Yes	58	38%
Happening of MSI during last 2 years (n=58)		
Yes, One time	38	24.8%
More than one time	20	13.1%

Majority of the sonographers (90 (59%) whom reported that they perceive their health as good, 38 (25%) as very good, 13 (9%) as fair and 12 (8%) as excellent. None of the sonographer responded to poor health status. While comparing health status to other persons, of same gender and age, 88 (58%) rated their health as above average, 23 (15%) as much above, 22 (14%) as below average, 18 (12%) as average and only 2 (1%) sonographers reported as much below. In the response of comparison of current health status to five years ago, most of the respondents (81 (53%) reported as same, 35 (23%) reported as better, 31 (20

%) as worse, 5 (3%) as much better and 1 as much worse. Majority of sonographers responded that they carry out physical activity every day (79 (52%), 29 (19%) reported the frequency as 3-4 times a week, 21 (14%) for once a week, 10 (7%) for 1-3times a month and 14 (9%) reported the frequency of carrying out physical activity less or never. While responding on average sleep 16 (11%) had 4-5 hours, 42 (28%) reported 5-6 hours, 50 (33%) responded on 6-7 hours, 34 (22%) on 7-8 hours and 11 (7%) were having more than 8 hours of average sleep. Moreover, 25 (16%) stated that they were having health issues and seeking medical consulting. As far as musculoskeletal injuries and health problems are concerned, out of 153 sonographers, 95 (62%) did not suffer from MSI, whereas 58 (38%) sonographers suffered from MSI. Out of 58 sonographers whom suffered from MSI, 38 (25%) respondents experienced one time and 20 (13%) stated more than one-time occurrence of MSI during work. These findings suggest that sonographers are following the protocol within the hospital environment which follows the procedure of occupational health.

Table 4: Body part effected by MSI (N=58)

Effected body parts	***f***	***%***
Neck	1	0.7%
Shoulder	12	7.8%
Upper Back	3	2.0%
Elbow	2	1.3%
Wrist/Hand	4	2.6%
Lower back	7	4.6%
Neck and Shoulder	1	0.7%
Neck and Lower back	3	2.0%
Neck, Shoulder, Wrist	1	0.7%
Neck, Shoulder, Lower back	3	2.0%
Shoulder, wrist, Lower back	3	2.0%
Shoulder and Upper back	2	1.3%
Shoulder, wrist, upper back	1	0.7%
Shoulder, upper back, lower back	2	1.3%
Shoulder and Elbow	2	1.3%
Shoulder and Wrist	1	0.7%
Shoulder and Lower back	2	1.3%
Wrist and lower back	1	0.7%
Wrist and Upper back	1	0.7%
Shoulder, wrist, Lower back		
Upper back, wrist, Lower back	1	0.7%
Neck, shoulder, Upper back, Elbow	1	0.7%
Neck, shoulder, Upper back, Lower back	1	0.7%
Neck, shoulder, Upper back, Lower back, wrist	1	0.7%
Neck, shoulder, Upper back, lower back, elbow	1	0.7%
Neck, shoulder, Upper back, lower back, elbow, wrist	1	0.7%

Many of the respondents opt multiple categories when it was asked that which body part was affected in the result of MSI. However, 12 Sonographers (7.8%) reported that due to MSI their shoulder was effected, 7 (4.6%) stated as lower back and 4 (2.6%) stated wrist/hand was effected.

Table 5: Self-reported possible causes of injury and treatment of MSI (n=58)

Causes of injury	***f***	***%***
Scanning	3	2.0%
Repetitive task	5	3.3%
Bending/ twisting	13	8.5%
Maintaining position for Prolong period	10	6.5%
High workload with reduced work interval	7	4.6%
Scanning and Bending	1	0.7%
Scanning and High workload with reduced work interval	3	2.0%
Repetitive task and Maintaining position for Prolong period	2	1.3%
Repetitive task and High workload with reduced work interval	2	1.3%
Repetitive task and Bending	2	1.3%
Maintaining position for Prolong period and High workload with reduced work interval	2	1.3%
Repetitive task, maintaining position for Prolong period and High workload with reduced work interval	2	1.3%
Scanning, bending, maintaining position for Prolong period and High workload with reduced work interval	1	0.7%
Repetitive task, bending, maintaining position for Prolong period and High workload with reduced work interval	2	1.3%
Scanning, Repetitive task, Bending/ twisting, maintaining position for Prolong period, High workload with reduced work interval	3	2.0%
MSI related Treatment		
Consultation to physician for MSI		
No	20	34.4%
Yes	38	65.5%
Work loss due to MSI		
No	34	58.6%
Yes	24	41.3%
Treatment for Injury		
Surgical	6	3.9 %
Medication	10	6.5%
Rest	10	6.5 %
Exercise	10	6.5 %
Surgical and Rest	1	0.7%
Surgical, Medication, Rest	2	1.3%
Medication, Exercise	3	2.0%
Medication, Rest, Exercise	7	4.6%
Rest, exercise	6	3.9%
Medication and Rest	3	2.0%
Symptom exacerbated by clinical practice after MSI		
No	28	48.2%
Yes	30	51.7%

Regarding the self-reported possible causes of injury while MSI happened sonographers (table 5) revealed that 13 (8.5%) were bending or twisting, 10 (6.5%) were maintaining a position for a prolonged period while scanning and 7(4.6%) stated that they were having high workload and reduced work intervals. Out of 58 sonographers 38 (66%) reported that they consulted to physician for injury. As a result of MSI, 24 (41%) sonographers reported that they lose a half day or more of work. For treatment options 10 sonographers (6.5%) reported simply they did rest, 10 (6.5%) opt exercise, 10 (6.5%) availed medical treatment. 30 (52%) sonographers responded that their symptoms been exacerbated by clinical practice after MSI.

Table 6: Sociodemographic correlates of MSI

	Age	Gender	Work experience	SES	Health	MSI	Physical activity	Sleep
Age	-							
Gender	-.077	-						
Work experience	.838**	-.077	-					
SES	-.054	-.197*	.002	-				
Health	-.060	-.139	.020	.183*	-			
MSI	.208**	.246**	.191*	-.181*	-.230**	-		
Physical activity	-.082	.191*	-.042	-.129	-.116	-.301**	-	
Sleep	-.024	-.173*	-.015	.245**	.250**	-.225**	-.066	-

**p < .01, *p < .05

Table 6 shows that age was found having strong positive correlation with work experience (r=.838, p<.01) and occurrence of MSI (r=.208, p<.01). Among gender, female sonographers were having significant correlation with MSI (r=.246, p<.01), carrying out less exercise frequency (r=.191, p<.05) and negative correlation with average sleep (r=-.173, p<.05). It suggests that less sleeping hours and less physical activity contribute to increase MSI occurrences. Those sonographers who were have more work experience suffer with more occurrence of MSI (r=.191, p<.05). Further the variable of SES was having positive significant correlation with health status (r=.183, p<.05) and strong positive correlation with average sleep (r=.245, p<.01). Those sonographers belong to upper middle or upper socioeconomic class were having negative correlation with MSI (r=-.181). Health status was having strong negative correlation with MSI (r=-.230, p<.01) and positive correlation with average sleep (r=.250, p<.01). Lastly, carrying out less physical activity was strongly correlated with MSI (r=-.301, p<.01). Moreover, MSI was found negatively correlation with average sleep (r=-.225, p<.01).

Discussion

Although much of the literature consist of prevalence of discomfort and pain among sonographers but dearth of studies was found for the prevalence of MSI among sonographers in KSA. This is may be due to the fact that they prefer to answer surveys rather than seeking medical help for causes (David, 2005). Participants in current study were selected from governmental and private hospitals in Riyadh. An important finding in this study is that only (38%) of sonographers suffered from MSI which represent lower prevalence than other worldwide studies among sonographers that ranges between 63.0–96.4% (Feng *et al*.,2016; Bolton and Cox, 2015; Claes *et al*., 2015; Evans *et al*., 2009; McGregor *et al*., 2009). This might be due to high awareness about occupational safety within sonographers in Riyadh or due to stigma of being diagnosed as having MSI (Morton and Delf, 2008).

Although The number of respondent of our study is not large enough compared to other studies (Evans *et al*., 2009; Pike *et al*., 1997) but it revealed important facts that sonographers at Riyadh should be aware of the relation between frequency of physical activity and average sleeping hours and occurrence of MSI as it was found that those who practice physical activity on regular bases didn't suffer from MSI as compared to those who were having sedentary life style. This result agrees with a study found that regular

practice of physical activities has been suggested as a way of promoting a healthy lifestyle and reducing the risk of MSI (Muir *et al*.,2004).

As far as most effected part of the body is concerned due to MSI, results show that the highest prevalence of MSI in the shoulder followed by lower back then wrists and hands. Feng and colleagues (2016) found that the prevalence of MSI was highest in the neck and shoulder, followed by the lower back, wrist/hand, upper back, and elbow. Zakerian *et al*., (2015) stated that most sonographers' pain was reported in shoulders, neck and wrists. Sonographers spend most of their time during scanning in sitting positions. There is a strong relation between sitting time and shoulder and neck pain (Hallman *et al*., 2015) and also lower back pain (Gupta *et al*.,2015). In our study the self-reported possible causes of MSI in sonographers was mainly bending or twisting, maintaining a position for a prolonged period while scanning and having high workload and reduced work intervals. This is compatible with the results of Feng *et al*. (2016) and Sunley (2006) who reported that the most common cause for MSI are awkward working posture while scanning, repetitive movement high workload (43.4 hours weekly). Bending or twisting the neck in sonographers may be associated with bending the trunk while sitting, and this lead to neck and back pain (Li *et al*., 2012). MSI in the shoulder was caused by maintaining shoulder abduction for a long time while scanning (Russo *et al*.,2002; Wihlidal and Kumar, 1997). Bending and twisting wrist and hand was risk factor for wrist/hand MSI (such as carpal tunnel syndrome) (Schoenfeld *et al*.,1999).

MSI is caused, or aggravated, by long sustained or short intensive periods of repetitive movements like twisting and bending (Kilbourn, 2004). Usually, heavy workload means a longer period of maintaining awkward neck /shoulders and wrist/hand postures, repetition, and high-pressure force (Feng *et al*., 2016). So frequent rest intervals can enhance the efficiency of performance and prevent occurrence of MSI (Coffin, 2014). This could be done by many strategies that can reduce the risks. As limiting repeated scanning, or staff rotations during sessions, allowing frequent breaks between sessions to minimize muscle fatigue and allow muscle recovery (Kilbourn, 2004). It is recommended that at the break time sonographers can perform gentle stretching and strengthening exercise for their neck, shoulder, back and wrists to release muscle spasm and enhance muscle recovery (Magnavita et al., 1999).

Some other important preventive guidelines include dynamic warming up exercise before applying scanning procedure for sonographers (Harrison and Harris, 2015). It is recommended to perform risk assessments into the ergonomics and process of scanning for sonographers regularly (Miles, 2005). This is very important to detect ergonomic problems. Suitable ergonomics guidelines include providing adjustable chairs and tables, proper positioning of patient and monitor and sufficient room to produce a report. (Ransom, 2002) This may lead to increased manufacturer involvement, to consider the design of the equipment to benefit the user. Further, it is recommended to raise awareness of sonographers in KSA and give them training courses about MSI symptoms, risk prevention, safe manual handling and ergonomics guidelines, correct use and adjustment of ultrasound device (Miles, 2005; Kilbourn, 2004).

Conclusion

Scholars could get new venues to explore the concept and technology used in west and when they are applied in a certain culture so they could examine that what could be the difference. Health professionals could get first-hand information regarding various strategies and how to utilize them in more effective manner in order to enhance their performance while using various equipment. Results are facilitating to understand the relationship of demographic variables, stressful work and mal practices of sonographers at their work. Significance of this study is not limited to scholars, students, teachers, professionals but also the healthcare providers who are directly involved in sonography. Moreover, quality management departments in healthcare settings can get benefit for future prevention of risks and injuries and develop safer environment.

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