

Musculoskeletal Disorders among Radiology Technologists at Governmental Hospitals- Gaza Governorates

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Abstract : This study aims to determine the prevalence and risk factors of musculoskeletal disorders (MSD) among radiological technologists (RTs) working at governmental hospitals in Gaza Strip. The design of this study is descriptive, analytical, cross-sectional one. The sample of this study consisted of all RTs 172 (136 male and 36 female). A pilot study on 15 RTs was conducted to test validity and reliability of the study instrument. Different statistical procedures used for data analysis including cross tabulation, percentage and Chi square.

The results showed that the overall prevalence of MSDs among study participants was 75.6%. MSDs were higher among females (91.7%) compared to males (71.3%). Back was the dominant site for MSDs and it constitutes 31.5% and stiffness was the dominant type of pain (31.5%). Eighty three point five percent of males and 84.8% of females RTs complained of moderate to severe MSP. The majority of RTs (79.2%) have intermittent episodes of pain and 56.2% of them complained of pain for more than 6 months. Regarding pain onset, 90.0% of RTs developed pain after they were employed in radiology department and 10.0% had MSP before working in radiology department. There were no statistical significant differences in MSP in relation to gender, age and years of experience. The highest complain of MSP (61.0%) was among RTs aged 40 years and less and the lowest complain (3.0%) was among RTs aged 51 – 59 years, 44.7% of those who complained of MSP were employed for 1 – 7 years. Among those who complained of pain, 82.3% asked for medical advice. Bending and twisting were the major risk factors for MSDs (88.4%) followed by lifting heavy objects and cassettes (85.5%), lifting and transferring patients (77.9%) and psychological pressure (77.3%), while sitting for long time (32.6%) and office work (19.2%) were the lowest risk factors. Concerning workplace environment, 58.7% of RTs reported that

lighting in their workplace was unsuitable, 54.6% of them reported that floor was unsuitable and 58.1% reported that staff number was unsuitable. The study concluded that workplace modifications is needed (lighting and floor) beside the need to increase the number of qualified staff. Priority suggestions to avoid MSDs were decreasing the number of radiology procedures performed each day, distributing assignments fairly between staff and avoiding lifting heavy objects.

Key words: Musculoskeletal Disorder (MSDs), Radiology Technologists (RTs), Governmental Hospitals, Gaza.

اضطرابات العضلات الحركية لدى فنيي الأشعة العاملين في المستشفيات الحكومية بقطاع غزة

ملخص الدراسة:

تعتبر اضطرابات العضلات الحركية من المشاكل واسعة الانتشار التي تؤثر على جودة الحياة والإنتاج. هدفت هذه الدراسة إلى تحديد مدى انتشار اضطرابات العضلات الحركية لدى فنيي الأشعة العاملين في المستشفيات الحكومية بمحافظات غزة، كما هدفت إلى التعرف على أهم العوامل التي تؤدي لحدوث تلك الاضطرابات، ولتحقيق هذه الأهداف فقد استخدمت الباحثة المنهج الوصفي التحليلي المقطعي عبر عينة للدراسة مكونة من 172 فني أشعة (136 ذكر، 36 أنثى). كما استخدمت الباحثة استبانة لقياس مدى انتشار العضلات الحركية بالإضافة لعمل دراسة استطلاعية على عينة مكونة من 15 فني أشعة بقصد التأكد من صدق وثبات أداة الدراسة مستخدمة اختبار صدق الاتساق الداخلي و معامل ألفا كرونباخ. ولتحليل البيانات استخدمت الباحثة برنامج الرزم الإحصائية للعلوم الإنسانية بالإضافة للمعالجات الإحصائية، التكرارات، النسب المئوية ومربع كاي.

ومن أهم نتائج الدراسة أن 75.6% من عينة الدراسة يعانون من اضطرابات العضلات الحركية، وهي في الإناث أعلى منها في الذكور (91.7% إناث، 71.3% ذكور)، وكانت الألم الظهر الأكثر انتشاراً بنسبة بلغت 31.5%، والشد العضلي أكثر أنواع الألم تكراراً بنسبة بلغت 31.5%، وأن 83.5% من الذكور و 84.4% من الإناث الألمهم بين شديدة ومتوسطة واستمر الألم لمدة تزيد عن 6 اشهر لدى 56.2% من فنيي الأشعة، كما ان 90.0% من المشتكين من ألم العضلات أفادوا بان الألمهم ظهرت بعد البدء بالعمل في قسم الأشعة.

كما انه لا يوجد فروق ذات دلالة إحصائية في ألم العضلات الحركية تعزي للجنس والعمر وسنوات الخبرة وكانت أكثر آلام العضلات الحركية تكراراً لدى فنيي الأشعة الذين تقل أعمارهم عن 40 عاماً بنسبة بلغت 61.0% وكانت أقلها تكراراً لدى فنيي الأشعة الذين تراوحت أعمارهم بين 51 – 59 عاماً بنسبة بلغت 3.0% فقط، وكان 44.7% من الذين يشتكون من آلام العضلات الحركية ممن تراوحت سنوات الخبرة لديهم بين 1 – 7 سنوات. ومن بين الذين عانوا من آلام العضلات الحركية فقد طلب 82.3% منهم نصيحة طبية لتخفيف الألم

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وهناك عوامل تؤدي لحدوث اضطرابات العضلات الحركية منها الانحناء والالتواء، وهي أكثرها خطراً بنسبة بلغت 88.4%، يليها حمل الأشياء الثقيلة وكاسيتات الأشعة بنسبة بلغت 85.5%، ثم حمل ونقل المرضى بنسبة بلغت 77.9% والضغط النفسي بنسبة بلغت 77.3%، بينما كانت أقل عوامل الخطر الجلوس لفترة طويلة بنسبة بلغت 32.6% والعمل المكتبي بنسبة بلغت 19.2%.

أما بالنسبة لبيئة العمل فقد أفاد 58.7% من أفراد عينة الدراسة أن الإضاءة في مكان العمل كانت غير مناسبة، 45.6% أفادوا أن أرضية القسم غير مناسبة، و 58.1% أفادوا أن عدد الفنيين في القسم غير كاف.

وبناء على ما سبق فإن الباحثة توصي بضرورة إدخال تعديلات في بيئة العمل (الإضاءة وأرضية القسم) وزيادة عدد العاملين في القسم. أما بالنسبة للاقتراحات للحد من اضطرابات العضلات الحركية فقد أظهرت النتائج أن أهمها تقليل العبء على العاملين، توزيع المهام بشكل عادل وتجنب حمل الأشياء الثقيلة.

Introduction

Musculoskeletal disorders (MSDs) are an important and costly occupational health problem with consequences for workers, employers and society. About 40 million workers are affected by work-related MSDs. Almost a quarter of the European workforce report that they have experienced muscular pain in their neck, shoulders, upper limbs and about one in every three suffers from low back pain (LBP). Within the European Union, MSDs are the single most common cause of sickness absence from work, early retirement, and disability payments. It is estimated that the direct annual costs of the MSDs account for 2% of the European gross domestic product [1]. Work related musculoskeletal disorders (WRMSDs) are major public health problems and the most serious in the field of occupational health. These disorders leading to disability, increased absenteeism and produce significant costs in treatments and compensations [2].

MSDs affect the body's muscles, joints, tendons, ligaments, bones and nerves. Most of them caused either by the work itself or by the employees working environment. Typically, MSDs affect the back, neck, shoulders, upper limbs and lower limbs [3]. The world Health Organization (WHO) has characterized work-related diseases as multi factorial to indicate that a number of risk factors (e.g., physical, organizational, psychological, individual, and socio-cultural) contribute to causing these diseases [4].

It has been shown that MSDs represent 40% of all chronic health problems, 54% of long term disability and 20% of health care utilization [5]. Every year in the European Union (EU), there are 5,720 fatal work-related accidents and millions of people injured from work place [3]. In the United States (US), MSDs are the most frequent complaint where about 33% of adults are affected by their signs and symptoms including limitation of motion or pain in joints or extremity and its prevalence generally increases with age [6]. MSDs comprises significant injuries and disability among radiology technicians (RTs), risk factors include lifting cassettes, carrying patients, transferring mobile devices, contact stress (wearing lead apron), awkward posture, force, static postures and others [7]. Another study found that 60% of Italian X-ray technologists' students have LBP, 20% have neck pain and 21% have shoulder pain [8].

In Gaza, governmental hospitals there are many factors that contribute to development of MSDs and pain / discomfort among RTs since they face many physical, psychological and occupational hazards. Therefore, this study was conducted to identify the most common MSDs and consequent MSP through determining its prevalence, characteristics, common risk factors and associations with demographic variables.

Methodology

Place of the study

This study was conducted at all radiology departments at Gaza governmental hospitals. The radiology centers provide Ultra-Sonography, Routine X-ray, Fluoroscopy, CT scanning, Panorama and MRI.

Sample and sampling method:

The researchers considered the population as the study sample for this study (census sample). The population of the study consisted of all RTs employed currently in all governmental hospitals in GS, who have technical responsibilities in radiology departments at the time of the study. The total number was 192 RTs (172 for actual sample, 15 for pilot study and 5 refused to participate in the study).

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Method of the study

The study is quantitative, descriptive, analytical, cross-sectional one.

Instrument of the study

Self-administered questionnaire was used in this study; it was distributed into six parts:

- The first part included personal and demographic data.
- The second part included characteristics of MSDs.
- The third part included risk factors that may lead to development of MSDs (15 items)
- The fourth part included workplace conditions (8 items).
- The fifth part included medical advice to manage MSDs (5 items).
- The sixth part included suggestions to avoid MSDs (10 items).

The researchers used the Correlation Coefficient test (Person Correlation test) to evaluate the construct validity of each domain of the study and total score of the scale. All the coefficients were positive and significant at the 0.05 level, and all correlation coefficients ranged between (0.414 - 0.773), that means a content validity for what it is supposed to be measured. While Cronbache' Alpha Coefficient test was used to measure the reliability of the instrument between each domain and the total score of the instrument. In this study the Cronbache' Alpha value of the instrument was 0.633 that is high and reflects reliability of the instrument .

Table (1): Correlation between each domain and total score of scale

Domain	Correlation
Risk factors	0.686
Work environment	0.521
Medical advice	0.414
Recommendations	0.773

The questionnaire has been prepared in suitable papers, pointed, cleared statements and proper arranged of ideas to make fullness of the questionnaire easy and simple. The face validity ratio was conducted by helping of experts to ensure relevance, clarity and completeness. Recommendations of the experts for changing were taken into consideration.

Eligibility criteria

The study included All formally employed RTs (males and females) working in Gaza governmental hospitals and have technical responsibilities at the time of the study. RTs that were pregnant have an experience less than one year and anyone who has a congenital deformity, or trauma (not caused by work conditions) was excluded.

Ethical consideration and procedures

The researchers were committed to all ethical consideration required to conduct a research. An official letter of approval was obtained from Helsinki Committee (Palestinian ethical committee). In addition, an official letter of request was obtained from MOH Director General of hospitals to conduct the study in radiology departments at governmental hospitals. Furthermore, each participant in the study received an explanatory letter attached to the questionnaire about the purpose of the study, confidentiality of the information and the fact that the participation is optional.

Collection of data

Data was collected by the researchers. Instructions were given to study participants before filling the questionnaire. All the questionnaires were arranged and have a serial number. Collection of data continued three weeks.

Data analysis

The researchers entered the data of the questionnaires using the Statistical Package for Social Sciences (SPSS version 13) with assistance of statistician and the steps were as follows: over viewing the filled questionnaires, coding of the questionnaires, data cleaning and designing data entry model.

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Statistical procedures used included; frequency tables for the study variables, means and percentage, cross tabulation and Chi square to calculate the relationships between categorical variables. P value less than or equal 0.05 was considered statistically significant.

Results

Sample characteristics

The study sample consisted of 172 RTs from all governmental hospitals in Gaza Strip. Of them, 136 were male and 36 female. Their age ranged between 23 – 59 years, with mean age 33.15. Their experience ranged between 1 – 30 years, with mean 8.90 years

Prevalence of musculoskeletal Disorders

Table (1) showed that the majority of RTs 130 (75.6%) complained of MSP, while 42 (24.4%) did not have MSP.

Table (1): Prevalence of MSP among study participants (N = 172)

	Male		Female		Total	
Presence of pain	Freq.	% within gender	Freq.	% within gender	Freq.	% within total
No MSP	39	28.7	3	8.3	42	24.4
Complain of MSP	97	71.3	33	91.7	130	75.6
Total	136	100.0	36	100.0	172	100.0

Table (2) illustrated that from RTs who complain of MSP, 11.3% of male RTs have mild pain, 59.7% have moderate pain, 23.8% have severe pain and 5.2% have very severe pain. On the other hand, 9.1% of female RTs have mild pain, 63.6% have moderate pain, 21.2% have severe pain and 6.1% have very severe pain. Generally, this result show that 60.7% of RTs complain of moderate MSP and 28.6% complain of severe and very severe MSP. The differences in pain intensity between male and female RTs were not statistically significant as chi square was 6.703 and P value = 0.152.

Table 2): Pain intensity and gender

Pain intensity	Male		Female		Total	
	Freq.	% within gender	Freq.	% within gender	Freq.	% within total
Mild	11	11.3	3	9.1	14	10.7
Moderate	58	59.7	21	63.6	79	60.7
Severe	23	23.8	7	21.2	30	23.2
Very severe	5	5.2	2	6.1	7	5.4
Total	97	100.0	33	100.0	130	100.0
Chi square = 6.703				P value = 0.152		

Site of MSP

Table (3) shows that back pain was the major complain among those who have MSDs and it accounts for 31.5%, followed by back and neck 19.2%, back, neck and shoulders 17.0% and neck and shoulders 14.6%.

Table (3): Site of pain (n= 130)

Site of pain	Frequency	Percent %
Back	41	31.5
Neck	9	6.9
Shoulders	4	3.1
Back + neck	25	19.2
Back + shoulders	10	7.7
Neck + shoulders	19	14.6
Back + neck + shoulders	22	17.0
Total	130	100.0

Type of MSP

Table (4) show that stiffness was the major type of MSP and it accounts for 40.76% of complains, followed by tingling and stiffness together 10.0% and stabbing and stiffness together 9.24%.

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Table (4): Type of MSP (n = 130)

Type of pain	Frequency	Percent %
Tingling	4	3.08
Burning	8	6.15
Stabbing	2	1.53
Stiffness	53	40.76
Numbness	1	0.76
Tingling + stiffness	13	10.0
Burning + stiffness	9	6.93
Stabbing + stiffness	12	9.24
Stiffness + numbness	8	6.15
Tingling + stabbing + stiffness	8	6.15
Tingling + stiffness + numbness	5	3.84
Stabbing + spasm + numbness	3	2.30
Tingling + burning + stabbing + spasm + numbness	4	3.08
Total	130	100.0

Relationship between demographic factors (age, gender, years of experience) and development of MSDs Pain and age

Tables (5,6) showed that the majority of RTs (61.0%) who complain of MSDs were young age (40 years or less), of them 43.6% were 30 years and less and 17.4% were between 31 – 40 years old. On the other hand, only 3.0% of participants aged between 51 – 59 years reported MSDs.

MSP intensity was moderate (51.6%) among RTs in the age group 30 years and less, 42.2% of the age group 31 – 40 years, 36.0% of the age group 41 – 50 years and 33.3% of the age group 51 – 59, while 28.0% of the age group 41 – 50 years, 21.5% of the age group 30 years and less and 20.0% of the age group 31 – 40 years complained from severe to very severe MSP. This result revealed that the highest complain of MSP was among RTs whose age was 30 years and less. Statistically talking, even though there were differences in complaints of MSP

between age groups, but these differences were not significant as Chi square was 12.646 and P value = 0.395.

Table (5): Distribution of MSP according to age

Age in years	30 and less (n = 93)		31 – 40 (n = 45)		41 – 50 (n = 25)		51 – 59 (n = 9)	
	Freq.	% within total	Freq.	% within total	Freq.	% within total	Freq.	% within total
No pain	18	10.5	15	8.7	5	3.0	4	2.3
MSP	75	43.6	30	17.4	20	11.0	5	3.0

Table (6) Distribution of pain intensity according to age

Age in years	30 and less (n = 93)		31 – 40 (n = 45)		41 – 50 (n = 25)		51 – 59 (n = 9)	
	Freq.	% within age	Freq.	% within age	Freq.	% within age	Freq.	% within age
No pain	18	19.4	15	33.3	5	20.0	4	44.4
Mild	7	7.5	2	4.4	4	16.0	1	11.1
Moderate	48	51.6	19	42.2	9	36.0	3	33.3
Severe	15	16.1	9	20.0	5	20.0	1	11.1
Very severe	5	5.4	0	0	2	8.0	0	0
Total	93	100.0	45	100.0	25	100.0	9	100.0
Chi square = 12.646					P value = 0.395			

Pain and years of experience

Tables (7,8) showed that the highest complain of MSP 44.7% was among RTs with 1 – 7 experience years and the lowest complain was among those with experience 22 – 30 years. 50.0% of RTs who have experience between 1 – 7 years, 42.1% of those who have experience between 8 – 14 years, 38.1% of those who have experience between 15 – 21 years and 38.5% of those who have experience between 22 – 30 years were complaining of moderate MSP. On the other hand, 20.0% of RTs who have experience between 1 – 7 years, 23.7% of

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those who have experience between 8 – 14 years, 23.8% of those who have experience between 15 – 21 years and 23.1% of those who have experience between 22 – 30 years were complaining of severe to very severe MSP. Even though there were differences in frequency and percentage of MSP between different years of experience, but these differences were not statistically significant as Chi square was 4.797 and P value = 0.964.

Table (7): Distribution of MSDs according to years of experience

Experience in years	1 – 7		8 – 14		15 – 21		22 – 30	
	<i>Freq.</i>	<i>% within total</i>	<i>Freq.</i>	<i>% within total</i>	<i>Freq.</i>	<i>% within total</i>	<i>Freq.</i>	<i>% within total</i>
No pain	23	13.4	11	6.4	5	2.9	3	1.7
MSP	77	44.7	27	15.7	16	9.3	10	5.8

Table (8): Distribution of pain intensity according to years of experience

Experience in years	1 – 7		8 – 14		15 – 21		22 – 30	
Pain intensity	<i>Freq.</i>	<i>% within age</i>	<i>Freq.</i>	<i>% within age</i>	<i>Freq.</i>	<i>% within age</i>	<i>Freq.</i>	<i>% within age</i>
No pain	23	23.0	11	28.9	5	23.8	3	23.1
Mild	7	7.0	2	5.3	3	14.3	2	15.4
Moderate	50	50.0	16	42.1	8	38.1	5	38.5
Severe	16	16.0	8	21.1	4	19.0	2	15.4
Very severe	4	4.0	1	2.6	1	4.8	1	7.7
Total	100	100.0	38	100.	21	100.0	13	100.0
Chi square = 4.797					P value = 0.964			

Characteristics of musculoskeletal pain

Nature of pain

Table (9) showed that the majority of RTs 79.2% have intermittent pain and 20.7% have continuous pain. The highest frequency was among male RTs and it accounts for 57.7%.

The results also showed that the highest frequency of complaining of intermittent pain was among RTs who have 1 – 7 years of experience.

Table (9): Distribution of MSP according to its nature

Variable	Nature of pain				Total	
	Continuous		Intermittent			
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	22	16.9	75	57.7	97	74.6
Female	5	3.8	28	21.5	33	25.4
Total	27	20.7	113	79.2	130	100.0
Years of experience						
1 – 7	13	10.0	64	49.2	77	59.2
8 – 14	7	5.4	20	15.4	27	20.8
15 – 21	5	3.9	11	8.5	16	12.4
22 – 30	2	1.6	8	6.1	10	7.7

Duration of pain

Table (10) showed that 56.2% of study participants have their pain for more than 6 months, of them 42.3% were male and 13.9% were female, also, those with least years of experience (1 – 7 years) have the highest frequency of complains (28.5%).

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Table (10): Distribution of MSDs according to its duration

Variable	Duration of pain				
	Since 1 week	Since 1 month	Since 3 months	Since 6 months	More than 6 months
Gender					
Male	2.3	7.7	10.0	12.3	42.3
Female	0.8	3.9	2.3	4.6	13.9
Total	3.1	11.6	12.3	16.9	56.2
Years of experience					
1 – 7	1.3	7.7	9.2	12.3	28.5
8 – 14	0.8	3.1	3.1	2.3	11.5
15 – 21	0.8	0.8	0	2.3	8.5
22 – 30	0	0	0	0	10.7

Risk factors of musculoskeletal pain

Table (11) showed that bending and twisting (88.4%) was the major risk factor perceived by study participants, followed by carrying cassettes and heavy objects (85.5%), lifting and transferring patients (77.9%), psychological pressure (77.3%), unsuitable work environment (74.4%) and sudden movements (73.9%). In contrast, office work and sitting for long time were the lowest risk factors.

Table (11): Response of participants on risk factors of MSDs

Risk factor	Yes (%)
Bending and twisting	88.4
Carrying cassettes and heavy objects	85.5
Lifting and transferring patients	77.9
Psychological pressure	77.3
Unsuitable work environment (lighting, ventilation ...)	74.4
Sudden movements	73.9
Crowd and inadequate space	72.1
Inadequate rest periods during work	70.3
Wearing lead apron for long time	54.7
Wearing uncomfortable shoes	51.2
Uncooperative colleagues	44.2

Sitting for long time to do procedures for patients	32.6
Office work (computer, typing, statistics ...)	19.2

Discussion

The results showed that 75.6% of RTs complained of MSDs. This result is higher than the results of study conducted in Gaza which showed that 68.7% of laboratory technicians were suffering of MSDs [9]. Another studies showed that 67.0% of X-Ray technologists complain of MSD at any site and 37.0% of X-Ray technology students suffered from MSDs [8,10], while the results of the current study were consistent with a study results which showed that 73% - 76% of nurses were complaining of pain due to MSDs [11] and the study that showed 77.3% of medical staff in radiology department reported at least one episode of pain during the last year [12].

The highest complain was back pain (31.5%), followed by back and neck (19.2%), back, neck and shoulders (17.0%) and neck and shoulders (14.6%). This result was consistent with many studies which revealed that back pain was the dominant complain [2, 8, 13, 14].

Regarding pain and gender, 11.3% of male RTs have mild pain, 59.7% have moderate pain, 23.8% have severe pain and 5.2% have very severe pain. On the other hand, 9.1% of female RTs have mild pain, 63.6% have moderate pain, 21.2% have severe pain and 6.1% have very severe pain. Differences in pain intensity between male and female RTs were not statistically significant as chi square was 6.703 and P value = 0.152. This result agreed with the results of a study which showed that there were no significant differences in MSP related to gender [8]. Another study showed that employed women tend to report more MSDs than men [15]

Concerning pain and age, 61.0% of RTs who complain of MSDs were young age (40 years or less), of them 43.6% were 30 years and less and 17.4% were between 31 – 40 years old. This result is inconsistent with a study which showed that chronic and disabling chronic pain was more common in older age groups among both genders [16]. Another study revealed that chronic widespread pain showed a

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systematic increasing gradient with age and was highest in the age group 59-74 yrs [17].

Regarding pain and years of experience, the results show that the highest complain of MSP 44.7% was among RTs with 1 – 7 experience years and the lowest complain was among those with experience 22 – 30 years. Differences in pain in relation to years of experience were not statistically significant as Chi square was 4.797 and P value = 0.964. This result agreed with a study results which showed that 52.7% of the study sample who complained of LBP have been employed for (7 years and above), 33.8% had (4-6 years) and 13.5% had (1- 3 years) [18].

In term of risk factors, bending / twisting was the major risk factor perceived by study participants (88.4%), carrying cassettes and heavy objects (85.5%), lifting and transferring patients (77.9%), psychological pressure (77.3%), unsuitable work environment (74.4%) and sudden movements (73.9%). These results were supported by some previous studies [19,20, 21].

Concerning workplace characteristics, 68.65% of RTs reported that their department design was suitable or very suitable, 68.15% reported that ventilation was suitable or very suitable, 62.25% reported that safety measures were suitable or very suitable and 66.35 reported that space was suitable or very suitable.

Conclusion

The study concluded that MSDs were high among RTs, with its consequence impact on RTs productivity and quality of their performance. The results highlighted the need for proper modifications to improve workplace conditions. Therefore, we recommend the need for equal distribution of assignments and tasks among RTs, taking in consideration staff abilities and skills, offer break times during work for relaxation to avoid overstretching of muscles, implementing educational programs regarding ergonomic issues to reduce pain and discomfort, including proper handling and transferring of patients and proper postures and movements and increase number of staff to meet demands and workloads in radiology department.

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