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Ergonomics Assessment and Work-Related Musculoskeletal Disorders in Construction Workers

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Abstract: ***Background: Millions of worker are being affected by work related musculoskeletal disorders (WRMSDs) every year.(1) WRMSDs occur due to repetitive motions, heavy lifting and awkward working position like bending, twisting and kneeling. The purpose of this study is to determine significant association between posture risk level and prevelance of work related MSDs. Methods: It is a associational study was conduct in raiwand road and Multan road. We collect data through VAS, Nordic questioner and RULA assessment sheet. We collect data from 195-construction worker, participant's chi square test was used to check significant of the study, and p value of 0.021 was considered. Results: Mean value of VAS to be found was 1.39±.489 SD, mean value of BMI to be found was 1.98±.436 SD, mean value of age to be found was 2.64±.927 SD and mean value of final score of RULA to be found 6.62±.488 SD. There was significant association between posture risk level and prevelance of low backache in construction workers as p value was 0.021. Low backache was found most prevalent in construction workers with frequency of 181(92.8%). Conclusion: There was significant association between posture risk level and prevelance of low backache in construction workers. Low backache was found most prevalent in construction workers. Score of RULA indicated that further investigation and changes immediately were required ergonomically***

Keywords: Work related musculoskeletal disorder (WMSDs), low back pain (LBP), ergonomic.

1. Introduction

1.1 Overview

Millions of worker are being affected by work related musculoskeletal disorders (WRMSDs) every year.(1) Our working population and health system are majorly affected by them which leads to their long-term sickness, absence from work and cause physical disabilities.(2)WRMSDs occur due to repetitive motions, heavy lifting and awkward working position like bending, twisting and kneeling. For example, bricklayers and drywall installers have musculoskeletal disorder due to their increase working in bent and twisting positions. Similarly, tile-workers spend more time in kneeled and stooped posture. Musculoskeletal disorders are 16% more in construction worker as compare to other. (Boschman et al., 2015)

"Ergonomics is the study of work action with significance on worker safety and productivity." The main outcome of ergonomics is to reduce musculoskeletal disorders(MSDs) and decrease work related injury.(3) The construction workers require ergonomics analysis to reduce MSDs caused by different awkward body posture and bad body positioning which can lead to MSDs. MSDs cause various injuries related to muscle , joints, nerves and blood vessels which also result in long term pain and time away from work.(4)

In construction industry, workers are engaged with highly physical demanding tasks which lead to musculoskeletal pain in different body regions.(5) Musculoskeletal disorder cause various injuries related to muscle , joints, nerves and blood vessels which also result in long term pain and time away from work.(6)

Musculoskeletal disorder highly affect lower back and waist in female than male. Where as hand, wrist, elbow, shoulder and neck were also affected.(7) Musculoskeletal disorder also cause carpal tunnel syndrom and stress fracture due to repetetive stress like hammering, drilling, sawing and cutting sheet metal with seissors. Large evidence shows that rate of morbidity, mortality and trouma are more in construction industry worker as compare to other industry worker.(8). Less severe case of musculoskeletal disorders are ligamentum sprain or strain and tear.The injured body part do not work properly as before the accident.(9) Risk factors of musculoskeletal disorders are individual factor, biomechanical and psychosocial factors. Individual factors include body weight and age , biomechanical factors are awkward body posture and psychosocial factors are related to job need , type and size of weight lifting.(10)Different factors that cause imbalance of body are unstable surfaces, stairs,surface height, slippery ways, manipulated load on different surface levels.(9).

Musculoskeletal conditions are major problems in young workers related to construction at starting of their careers. So traning programs are held to avoid and reduce musculoskeletal conditions. Type and time of construction worker also play an important role to develop musculoskeletal disorders.(11)Manually lifting of heavy loads, if load hit the worker can lead to injury due to falling and slipping.Similarly, light weight lifting for prolonge period can cause fatigue. Envoirmental conditions can also cause musculoskeletal disorders like temperature, ventilation. In winter, construction work required more muscle force to handle tools, materials and also cause rapid fatigue.(Schneider, 2001).The psychosocial factors also play role in WRMSDs like mentaly burden, social help,

family suport and job insecurity. (Ekpenyong and Inyang, 2014)

As for as previous studies, most studies were done in western countries. No proper study in pakistan has been conducted yet regarding musculoskeletal disorders in construction workers. I will conduct this research first time in pakistan on WRMSDs. I will conduct this research on male construction workers as males are more involved in this profession in our society. It is a common occopation in pakistan so that's way I will choise this topic and I have seen many patient with musculoskeletal pain in physisal therapy OPD.

1.2 Objectives

1: To determine frequency of work related MSDs in construction worker of lahore city. 2: To determine ergonomic assessment of construction workers of lahore city. 3: To determine association between posture risk level and frequency of work related MSDs.

1.3 Rationale

Musculoskeletal disorders are common among construction workers due to bad posture.This research will help to determine prevalence of WRMSDs and posture analysis at work station in construction workers. This will help to prevent further injury in construction workers and improve efficiency of work and quality of human life.

1.4 Operational defination

Nordic questionnaire and RULA assessment sheet and VAS will be used in this research. Nordic questionnaire defines the area of disorder in body , RULA assessment sheet defines the ergnomic positioning of body and VAS define intensity of pain. Validity of Nordic musculoskeletal questionnaire for mearing tool is 86%.(12)

Reliability of VAS for measuring pain intensity is 90%.(13)

1.5 Hypothesis:

Null hypothesis
There is no association between posture risk level and prevalence of low backache.

Research hypothesis
There was a significant association between posture risk level and prevalence of low backache

1.6 Materials and Methods

1.6.1 Study design
Associational study design was used in this research.

1.6.2 Setting and Duration:
This study was conducted at construction sites in multan road , raiwind road lahore within 3 months.

1.6.3 Inclusion Criteria:
- Construction workers within 20 – 50 years of age will be included in this study.
- Workers with working experience of more than 1 year will be considered.

1.6.4 Exclusion Criteria:
- Construction workers with trauma at construction site and road traffic accident.
- Construction workers with recent infections, systemic disease and inflammotory conditions.

1.6.5 Sampling technique:
Simple random sampling technique was used.

1.6.6 Data collection:
Nordic questionnaire, RULA assessment sheet and VAS was used in this research. Goniometry was performed to do postural analysis for RULA assessment sheet.

1.6.7 Sample size:
Sample size is 195constructure worker out of 20,000 worker population in lahore.This sample is calculated by Rao soft sample size calculater according to formulas

$x=Z(^{c}/_{100})^{2}r(100-r)$

$n=^{N\,x}/_{((N-1)E^{2}+x)}$

$E=Sqrt[^{(N-n)x}/_{n(N-1)}]$

The 5% margin of error with 95% confidence level and 85% estimated response rate.

1.6.8 Statistical tool:
Chi square was used to find association between posture risk level and prevalence of low backache

1.6.9 Ethical consideration:
I will consider all the ethical values of participants, respect the respondents and never use the confidential information of subject for any purpose except for research purpose only.

2. Results

Age:

Variables	*Frequency*	*Percentage*
15-25	27	13.8
26-35	50	35.6
36-45	84	43.1
46-55	34	17.4
Total	195	100

Frequency of age between 15-25 were 27(13.8%), frequency of age between 26-35were 50(35.6%), frequency of age 36-45 were 84(43.1%) and frequency of age between 46-55 were 34(17.4).

BMI:

Variables	*Frequency*	*Percentage*
Underweight	20	10.3
Normal	158	81.0
Obese	17	8.7
Total	195	100

Frequencies of construction worker having underweight worker were 20(10.3%), frequencies of worker having

normal BMI were 158(81.0%) and obese frequencies were 17(8.7%).

VAS:

Variables	*Frequency*	*Percentage*
Mild pain	119	61.0
Moderate pain	76	39.0
Severe pain	0	0
Total	195	100

Frequencies of construction workers having mild pain were 119(61.0%), frequencies of moderate pain were 76(39.0%) and frequencies of severe pain were 0.

Nordic:

Variables	Frequency	Percentage
Neck pain		
yes	149	76.4
no	46	23.6
Shoulder pain		
right shoulder	81	41.5
left shoulder	12	6.2
both	72	36.9
no pain	30	15.4
Elbow pain		
right elbow	52	26.7
left elbow	120	61.5
both	32	6.7
no pain	10	5.1
Wrist pain		
right wrist	68	34.9
left wrist	33	16.9
both	71	36.4
no pain	23	11.8
Upper back pain		
Yes	144	73.8
No	51	26.2
Lower back pain		
yes	181	92.8
no	14	7.2
Hip/thigh pain		
right hip	21	10.8
left hip	21	10.8
both	56	28.7
no pain	97	49.7
Knee pain		
right knee	30	15.4
left knee	20	10.3
both	47	24.1
no pain	98	50.3
Ankle/foot pain		
right foot	22	11.3
left foot	19	9.7
both	58	29.7
no pain	96	49.2

Frequency of constructions worker having neck pain were 149(76.4%) and having no pain 46(23.6%). Frequency of constructions worker having right shoulder pain were 81(41.5%), frequency having left shoulder pain were 12(6.2%), frequency having both shoulders pain were 72(36.9%) and frequency having no pain were 30(15.4%). Frequency of construction worker having right elbow pain were 52(26.7%), frequency having left elbow pain were 120(61.5%), frequency having both elbows were 32(6.7%) and frequency having no pain were 10(5.1%). Frequency of construction worker having right wrist pain were 68(34.9%), frequency having left elbow pain were 33(16.9%), frequency of both wrist pain were71 (36.4%) and frequency having no pain23 (11.8%). Frequencies of construction worker having upper back pain were 144(73.8%) and having no pain were 51(26.2%). Frequencies of lower back pain were 181(92.8%). Frequency of right and left hip were 21(10.8%), frequency of both hip were 56(28.7%).

Frequencies of construction worker having right knee pain were 30(15.4%), frequencies of left knee pain were 20(10.3%) and frequency of both knee were 47(24.1%). Frequencies of construction worker having right ankle/foot pain were 22(11.3%), frequencies of left ankle/foot pain were 19(9.7%) and frequency of both foot were 58(29.7%).

RULA Assessment:

Variables	Interpretation	Frequency
1-2	Acceptable	0
3-4	Investigate further	0
5-6	Investigate further and change soon	75
7	Investigate further and change immediately	120

Frequencies of upper arm position were 133(68.2%), frequency of lower arm position were 177(90.8%) and frequency of trunk position were 118(60.5%). Mean value of VAS to be found was 1.39±.489 SD, mean value of BMI to be found was 1.98±.436 SD, mean value of age to be found was 2.64±.927 SD and mean value of final score of RULA to be found 6.62±.488 SD. There was significant association between posture risk level and prevelance of low backache in construction workers as p value was 0.021. Low backache was found most prevalent in construction workers with frequency of 181(92.8%).

Chi square test:

	Value	df	significant
Person chi-square	5.342	1	.25

3. Discussions

In this research, we found that the construction worker having 36.9% shoulder pain and other researches shows 11%(14). The frequency of right shoulder pain is higher then left shoulder pain because construction workers mostly do their work with right hand. We found higher frequency of neck pain 76.4% but other research shows 25.3%, (6). We found that highest problem of constructions workers, which affect the quality of work and life is LBP 92.8% but other research found 30.9%(10).The higher frequency of LBP is due to different awkward body posture and bad body positioning. We determine that the workers having knee pain 24.1% and other research show 38.4%. We show less knee problems as compare to other research and having wrist problems 36.4% but other research show 42.4%.(11)

4. Conclusion

There was significant association between posture risk level and prevelance of low backache in construction workers. Low backache was found most prevalent in construction workers. Score of RULA indicated that further investigation and changes immediately were required ergonomically

5. Limitations/Recommendations

Further investigations required for ergonomic assessment

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