"PREVALENCE OF RISK FOR WORK RELATED MUSCULOSKELETAL DISORDERS IN MALE STANDING MACHINE OPERATORS IN COTTON TEXTILE INDUSTRY AT MIDC KUPWAD, SANGLI"

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ABSTRACT

BACKGROUND – Work related musculoskeletal disorders (WMSDs) is a multifactorial disease in which work environment and performance contribute significantly to causation of disease. There are 20 million workers involved in manufacturing textile goods. Textile industry involves performance of monotonous, highly repetitive and high speed task performed in non-neutral awkward posture. It has now become a necessity to find risk for WMSDs in such industries.

AIM- Prevalence of risk for work related musculoskeletal disorders in male standing machine operators in cotton textile industry at MIDC Kupwad,Sangli.

METHOD – 245 male standing machine operators (n=245) working in various sectors of cotton textile industries were screened according to inclusion criteria. Video was captured and analysis was done using Kinovea software and REBA worksheet, risk of work related musculoskeletal disorders was found out.

OUTCOME MEASURE-REBA and Kinovea software.

RESULT– The risk of MSDs with work experience showed IC **-**0.8382 (0.1791-3.9253) whereas on REBA, Transporting and Sizing was at very high risk of musculoskeletal disorders that requires immediate implement. Other sectors were at moderate risk. Trunk was at higher risk among all body segment.

CONCLUSION- This study found out that workers in cotton textile industry are at risk of MSDs due to prolong and repeated posture adapted by them. Workers involved in the sizing and transporting were at

very high risk of MSDs hence immediate changes is needed. Whereas workers working in sewing, threading, cutting, packaging and checking quality are at moderate risk and hence investigation is required. Trunk is highly at risk among all body segment followed by wrist, neck, leg, upper arm and lower arm.

KEYWORDS-MSDs, Kinovea software, WRMSDs, cotton textile industry, REBA.

INTRODUCTION

India is the second largest producer of textile goods worldwide, which account for 20% of the industrial output nationally. With 20 million workers involved in manufacturing textile good, employed in 1175 cotton mills across country, representing largest major occupational group. There are many hazards and risks to workers working in textile sectors, ranging from manual handling and working with dangerous machinery ,to noise and exposure to dangerous substance. [1]

The World Health Organization (WHO) defined work-related diseases as "Multifactorial diseases in which the work environment and the performance of work contribute significantly to the causation of the disease.[2] Work-related musculoskeletal disorders" (WMSDs) is a term used to describe a painful or disabling injury to the muscles, tendons or nerves produced or intensified by work". Bernardino Ramazzini first noticed work related disorder and documented disorder as "insistent and irregular movement in unnatural postures".[3] 50–70% individuals developed WMSDs when exposed to poor working environments during working for the job which was reported by WHO[4]. Epidemiology and experimental science both indicate risk of WMSDs which are due to heavy lifting, repetitive hand motion, static work in which the body is in fixed posture, vibrations ,awkward posture and any of these in combination along with an undesirable psychosocial work environment.[3]

There are three categories of musculoskeletal hazards such as biomechanical hazards, additional hazards and individual hazards. The biomechanical hazards are due to high force, repetitive and awkward posture while additional hazards are caused due to vibration, temperature and contact stress and the individual hazards are because of age, body size, previous injury and genetic predisposition. The Musculoskeletal disorders have an impact on socio-economic status. People may suffer the financial loss that may cause psychological disturbance[5].

Textile industry often involves non neutral awkward joint posture due to the performance of monotonous, highly repetitive and high-speed tasks. These places workers at risk of developing WMSDs of the neck, upper extremities, back and lower extremities.[6] Work-related health problems are most common MSDs, with almost one in four workers reporting backache and one in five complaining of muscular pain. The cause of WMSDs in textile sectors are Manual handling, lifting, holding, putting down, pushing, pulling, carrying or movement of a load.[7]

Working posture and specific use of limbs for various work-related activities can lead to musculoskeletal symptoms due to poor ergonomic design at the workplace that has led to severe musculoskeletal morbidity among employees. In textile industries Cutters, whose working requires lifting and carrying of fabric rolls as well as operation of hand-held or computer-operated cutting machines, typically performed in non-neutral postures of the fingers, wrist, elbows, shoulders and neck ,hence are at risk for developing carpal tunnel syndrome, ganglion cysts, forearm tendinitis, epicondylitis, shoulder disorders including bicipital and rotator cuff tendinitis, rotator cuff tears and neck disorders.[6] Operators working in standing posture has lead to increase in production and manufacturing but at same time lead to increase in ergonomic risk and MSDs among operators due to poor work posture performing for long duration, leaning forward for better concentration and visual control additionally have to arrange thread tension ,clean machines.[8]

Rapid entire body assessment (REBA) it evaluates different body parts: upper limbs lower extremities, trunk and neck it identifies the forced postures adopted by workers thus develop improvement measures if necessary, it determines five level of risk from low to high. It help in determining musculoskeletal disorders in various fields. REBA tool has advantages like being cost effective, application is easy and most conflictive ergonomic can be assessed for each body part. Disadvantages of REBA are it cannot analyse sequence of posture only individual posture ,task evaluation will be determined by evaluator and it only determines intensity of posture not the frequency or duration throughout the day[9].Difficulty in determining accurate angles of the body parts, that will lead to inaccurate assessment. While using, assessors might miss out some of extreme postures when assessing a continuous set or sequence of task.[10] In contrast, Kinovea is a free software it allows the user to control temporal parameters and measure angles and distances [11] used for the analysis, comparison, and evaluation of sports and training.[12] Kinovea is a free 2D motion analysis software that enables the establishment of kinematics parameters. Under GPLv2 license, this low cost technology created in 2009 via the non-profit collaboration of several researchers, athletes, coaches and programmers from all over the world.[13] Currently the official version is 0.8.15.55 although 0.8.24 has been used experimentally and the most recent update is 0.8.25. Kinovea allows the user to control temporal parameters and measure angles and distances frame by frame.[11]

Working Posture determines the risk of work related musculoskeletal disorders. Studies show risk of WMSD in sitting posture but there is no study done on male standing machine operators working in various sectors. So the purpose of this study is to find out risk of WMSDs in male standing machine operators working in cutting, packaging, threading, Sewing, checking quality, and transporting the textile.

AIM

To find out the Prevalence of risk for work related musculoskeletal disorders in male standing machine operators in cotton textile industry at MIDC Kupwad**,** Sangli.

OBJECTIVES

- To find out risk of neck trunk and leg work related musculoskeletal disorders due to postural loading, frequently adapted abnormal posture.
- To find out risk of arm and wrist work related musculoskeletal disorders due to repetitive task, static posture and abnormal power grip.
- To find out risk of entire body musculoskeletal disorder due to forceful exertion.

MATERIAL AND METHODOLOGY

Ethical clearance was obtained from institutional ethical committee. Permission from Industrial owner was taken for study. Subject were selected on basis of inclusion and exclusion criteria. This cross sectional study was conducted in cotton textile industry of Miraj taluka,245 male workers working in the sewing , sizing, cutting, transporting, packaging , Threading, checking quality were screened.21-45 age group with working experience more than 2 years were included. . Subject were selected on basis of inclusion and exclusion criteria. Subjects with age group-21 – 45 years , BMI -18.5 to 24.9 kg/m^2 , whose Working experience is more than 2 year , with Working of minimum 8 hours in a day were selected**.** Subjects with recent soft tissue injurie ,recent fractures ,with Deformity , diagnosed with Musculoskeletal , Neurological, Metabolic and Cardiovascular conditions were excluded so as to purely find out risk factor due to posture. Demographic data which included age, gender, work experience of subjects was collected .Prior to this subjects were given written consent form in vernacular language. Video was captured by using smartphone placed at height of 1.04m on tripod at distance 1.6m analysis of Posture was done by using Kinovea software landmarks were placed over joints and video was captured and recorded at each workstation. All recorded videos were analyzed using Kinovea software (version 0.8.15) to minimize observational errors and accordingly REBA worksheet was filled and risk of musculoskeletal disorders was found out. Risk of musculoskeletal disorder was evaluated and recorded. Statistical analysis was done using SPSS version 20.
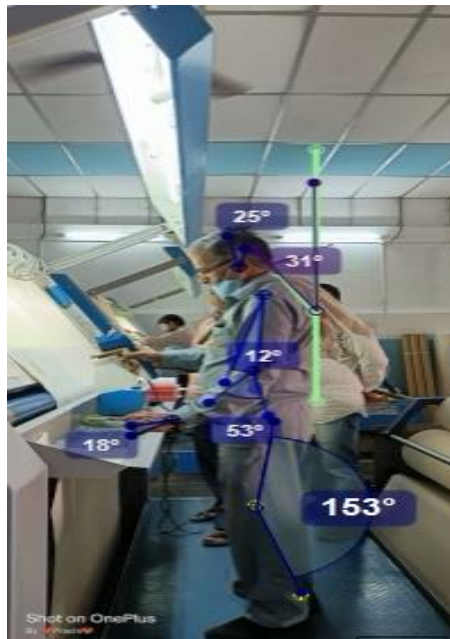
kinovea software analysis

RESULT

Data analysis was performed by using SPSS version. Relationship between working history, working Occupation and correlation of each sectors working in cotton textile industry with risk of musculoskeletal disorders was performed by using Monte-Carlo Stimulation.

Table1: Relationship between work history and musculoskeletal disorders

Particulars	Musculoskeletal disorders		Odd's ratio(CI)	P value
	Negative	Positive		
Sizing	75.6%	24.4%		
Cutting	43.2%	56.8%		
Packaging	87.9%	12.1%		
Threading	90.29%	9.71%	0.8382	$_1{}^M$
Sewing	48.8%	51.2%	(0.1791-3.9253)	
Checking quality	92.69%	7.31%		
transporting	85.4%	14.6%		

Table 2: Relationship between all the work occupations and musculoskeletal disorders

	Musculoskeletal Disorders		Odd's ratio(CI)	P value
	negative	Positive		
Occupations	36.83	63.17%	68.5354 ((4.2061-2313.0761)$^{\#}$	0.0009995$^{M\#}$

Table 3: Correlation of each occupation with other variables

| VARIABLES	R-VALUE	P-VALUE
Age	0.113	0.971
Cutting	0.172	0.002***
Packaging	0.024	0.019**
Threading	0.016	0.047**
Sewing	0.208	0.005***
Checking quality	0.136	0.028**
transporting	0.005	0.002***

Above tables suggest there was significant relationship between each sectors working in cotton textile industry. There was high significance seen in cutting and transporting sector (p=0.002.) with risk of musculoskeletal disorders.

Risk of each body segment according to REBA score was analysed and highest risk factor of each sector was found out.
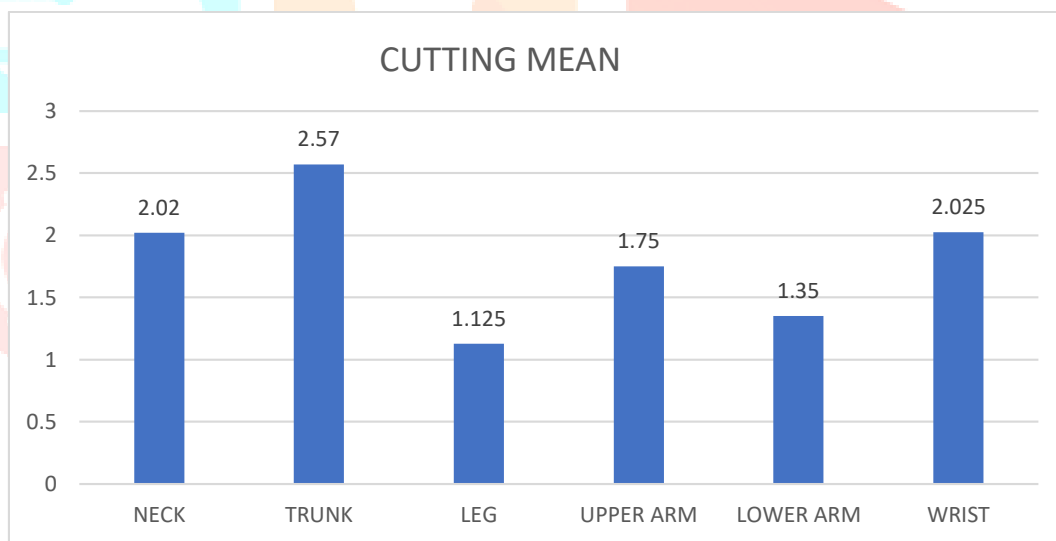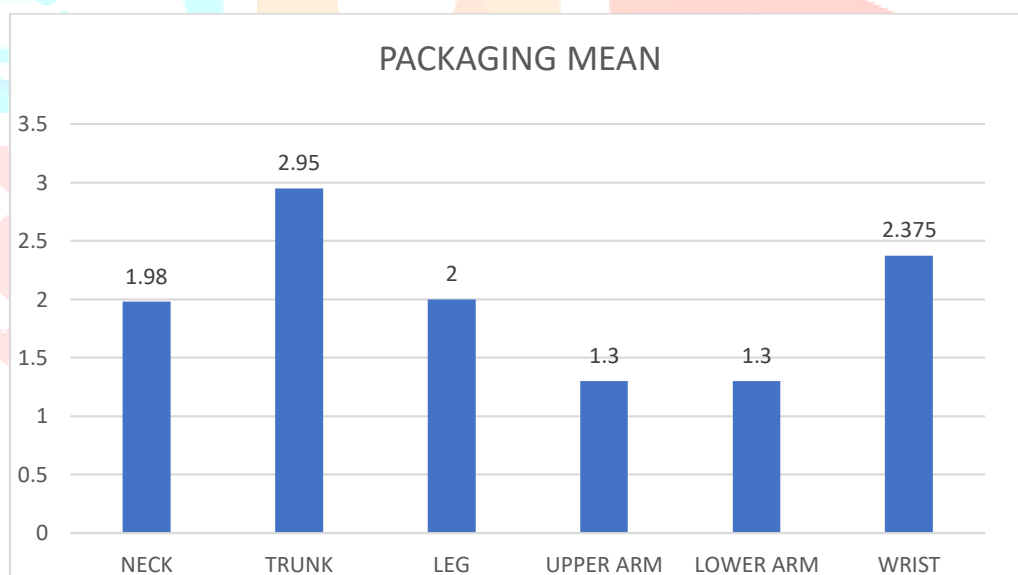

Graph-1 risk factor of each body segment in cutting sector

Musculoskeletal risk in cutting sector mean value for neck -1.98, trunk - 2.95 , leg -2 ,upper arm -1.3, lower arm -1.3 and wrist- 2.375.
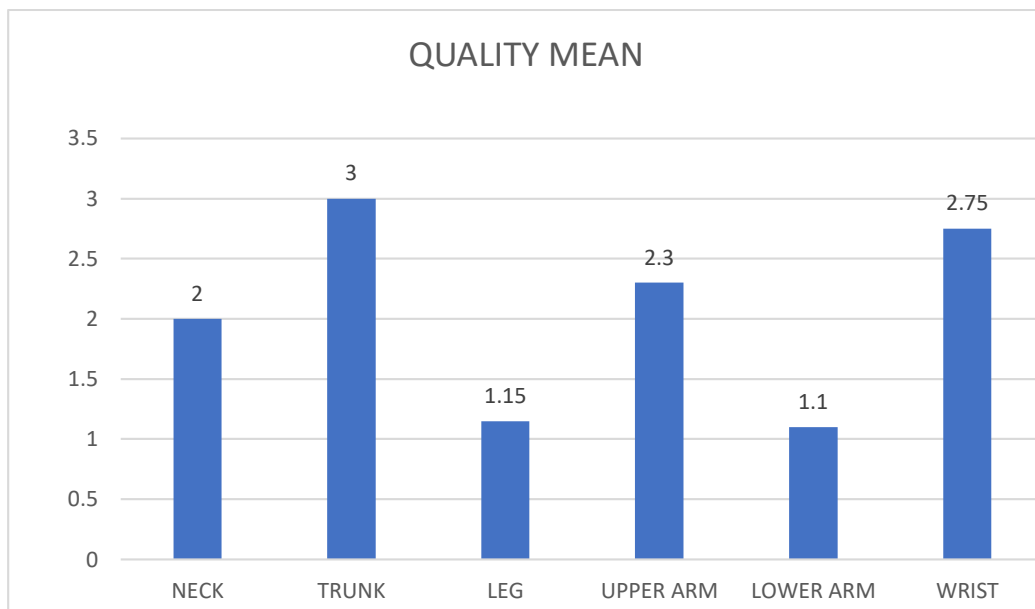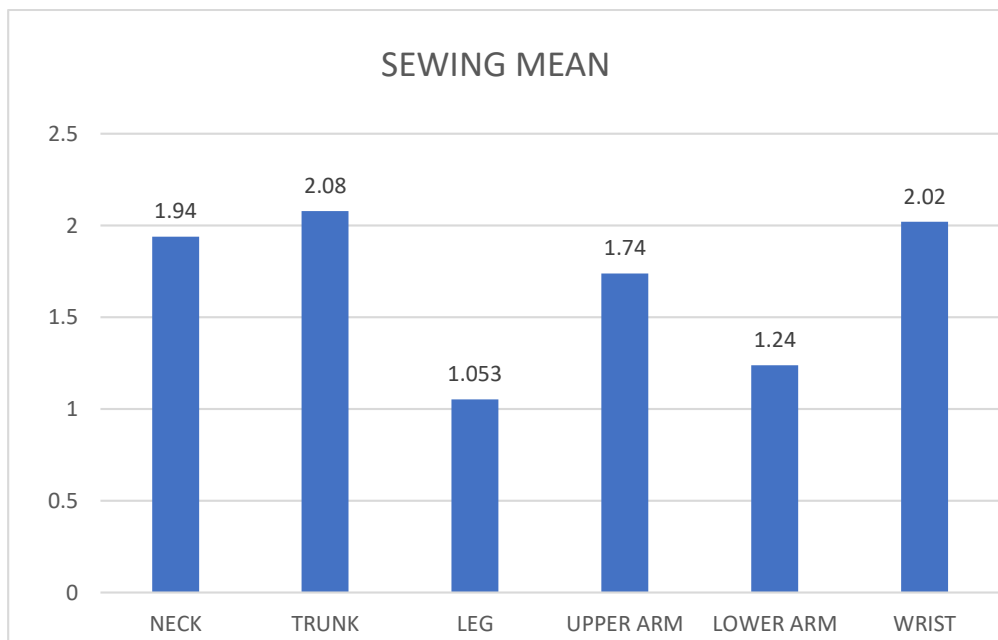
Graph2- risk factor of each body segment in quality sector

Finding quality of textile sectors mean value for neck- 2, trunk-3 , Leg -1.15 ,upper arm -2.3, Lower arm -1.1 and Wrist-2.75.
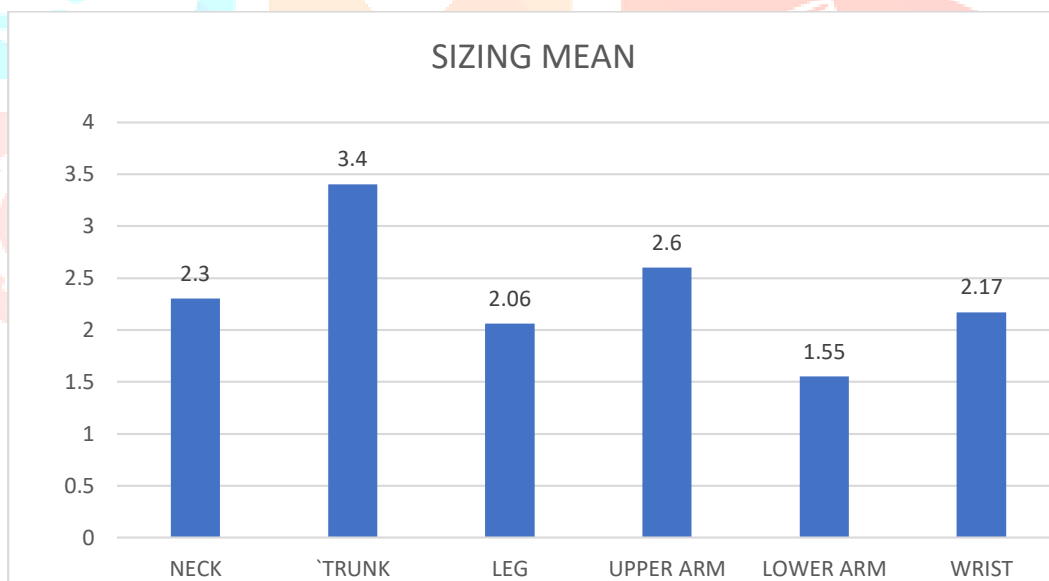

Graph3- risk factor of each body segment in packaging sector

In Packaging sector mean value for neck -1.98, trunk-2.95, Leg -2, upper arm-1.,lower arm -1.3 and wrist-2.375..

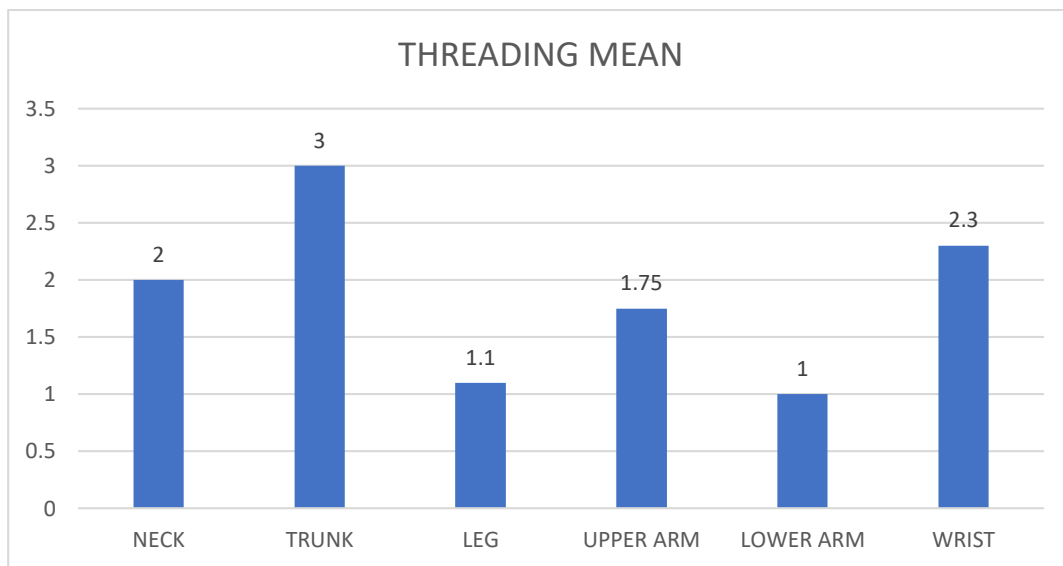*Graph 4- risk factor of each body segment in sewing sector*

In Sewing sector mean value for neck -1.94 , trunk-2.08,leg -1.053 ,upper arm -1.74 ,lower arm-1.24 and wrist- 2.02.

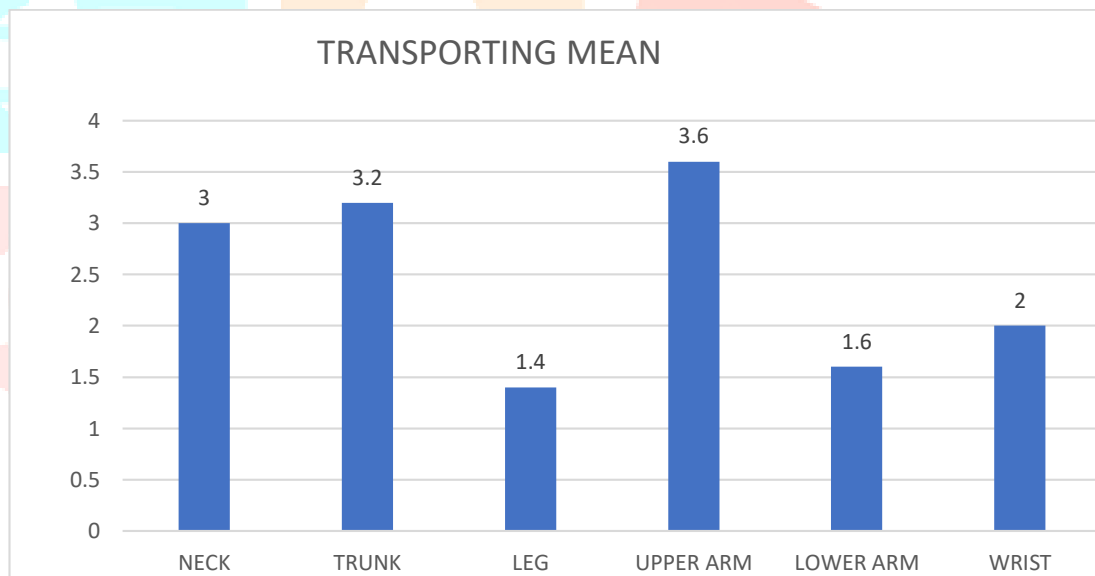*Graph 5- risk factor of each body segment in sizing sector*

In sizing sector mean value for neck -2., trunk-3.4, leg -2.06 ,upper arm -2.6 ,lower arm -1.55 and wrist -2.17
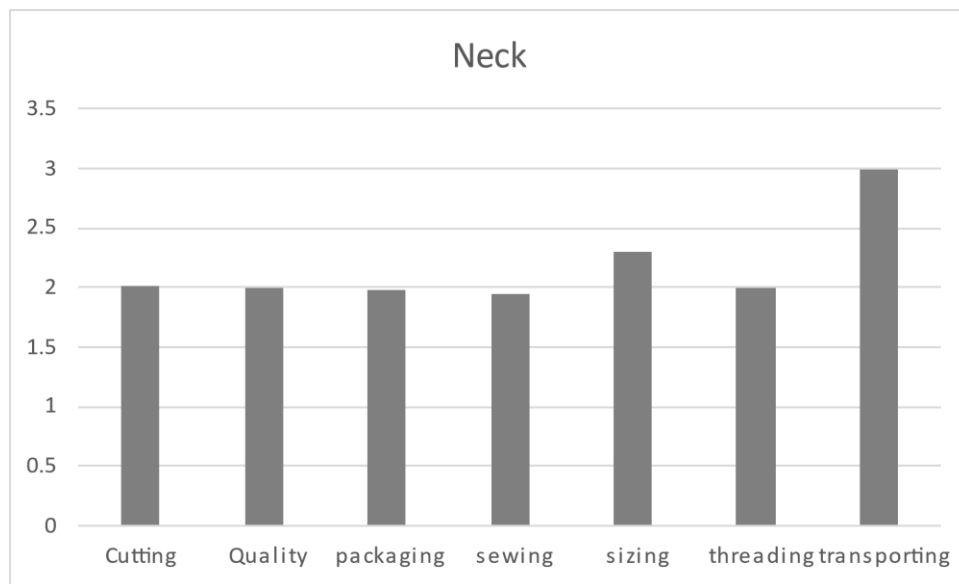
Graph6- risk factor of each body segment in threading sector

In Threading sector mean value for neck- 2 , trunk -3, leg -1.1 ,upper arm -1.75.,lower arm -1 and wrist -2.3.


Graph 7- risk factor of each body segment in transporting sector

Transporting sector mean value for neck -3, trunk-3.2, leg -1.4, upper arm-3.6,lower arm 1.6 and wrist -2.

Graph 8- risk factor of neck in every sectors.

Above graph shows the mean value of neck REBA score in different sectors cutting sector -2.02,checking quality -2, packaging-1.98 , Sewing-1.94 ,sizing-2.3 ,threading-2,transporting-3.It was found that neck was at higher risk in transporting sector.
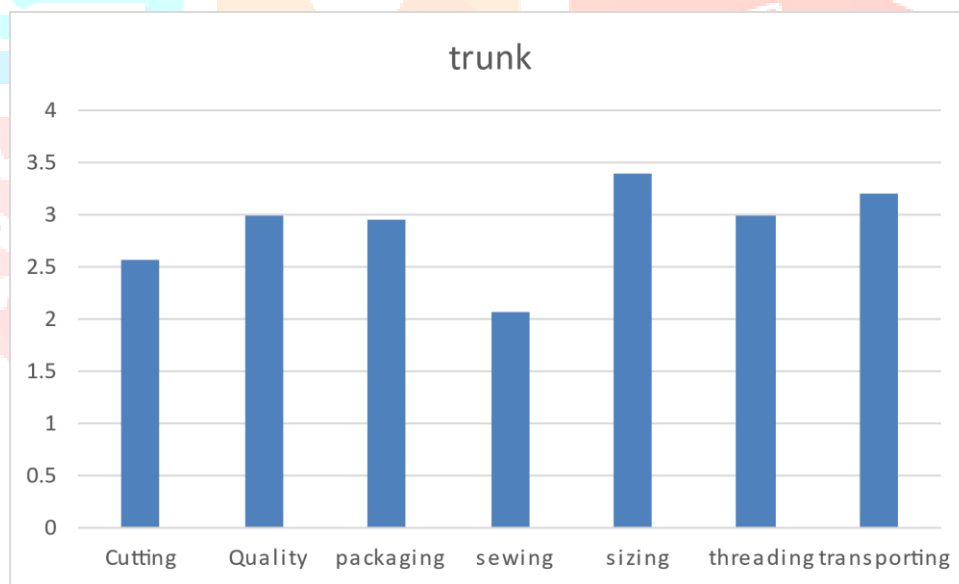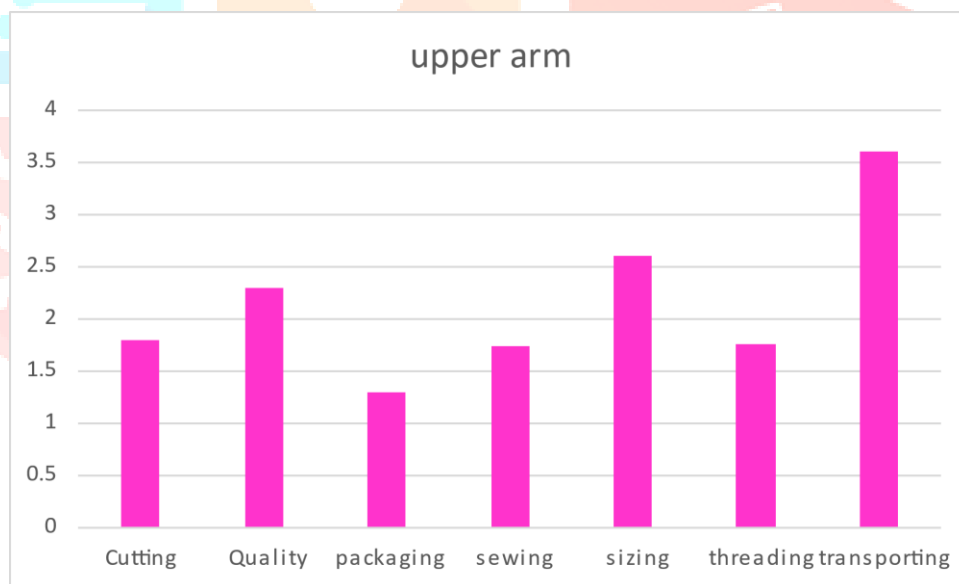

Graph 9- risk factor of trunk in every sectors.

Above graph shows the mean value of trunk REBA score in different sectors cutting sector-2.57, checking quality-3 , Packaging-2.95, sewing-2.08 ,sizing -3.4 ,threading-3, transporting -3.2.it was found that sizing among all sectors was at higher risk for trunk.
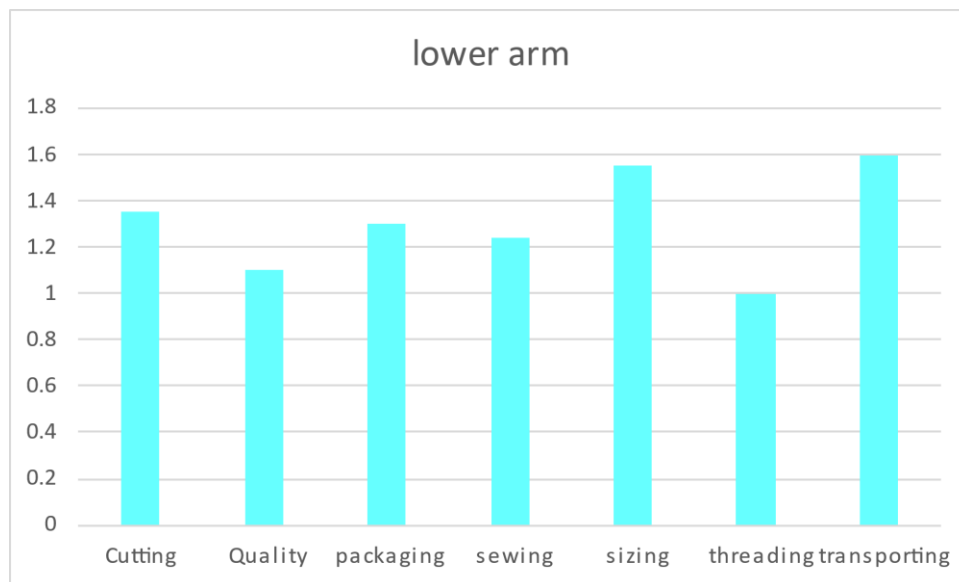
Graph 10- risk factor of leg in every sectors

Above graph shows the mean value of leg REBA score in different sectors cutting sector - 1.125,checking quality -1.15, packaging- 2 , Sewing-1.053 ,sizing-2.06 ,threading-1.1,transporting-1.4.It was found that leg was at higher risk in sizing.

Graph 11- risk factor of upper arm in every sectors

Above graph shows the mean value of upper arm REBA score in different sectors cutting sector -1.79, checking quality -2.3, packaging- 1.3 , Sewing-1.74 ,sizing-2.6 ,threading-1.75,transporting-3.6.It was found that upper arm was at higher risk in transporting sector.

Graph 12- risk factor of lower arm in every sectors

Above graph shows the mean value of lower arm REBA score in different sectors cutting sector -1.35, checking quality -1.1, packaging- 1.3 , Sewing-1.24 ,sizing- 1.55 ,threading-1,transporting-1.6.It was found that lower am was at higher risk in transporting sector.
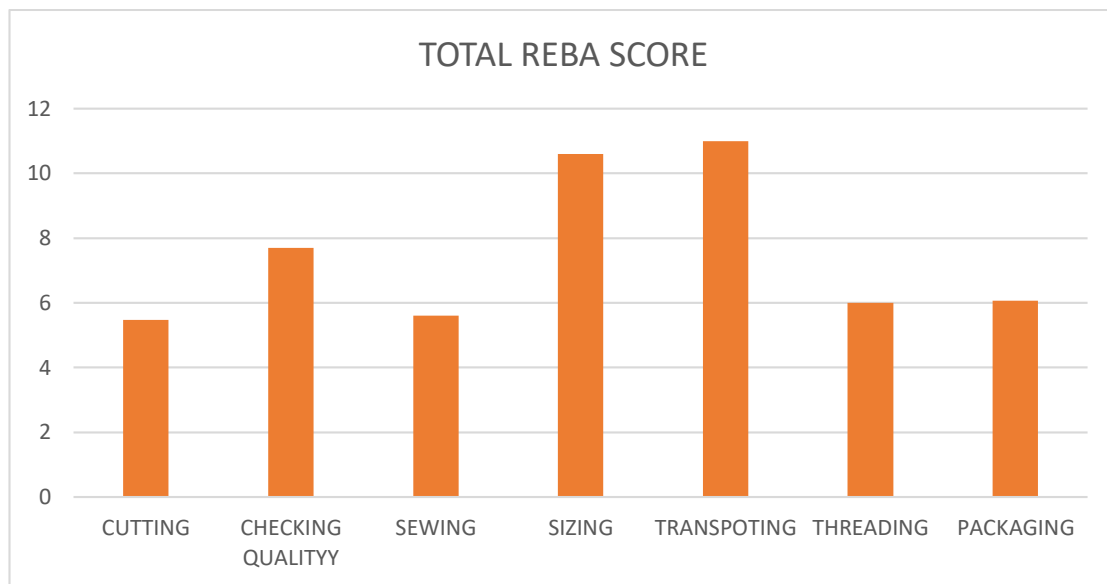

Graph 13- risk factor of wrist in every sectors

Above graph shows the mean value of wrist REBA score in different sectors cutting sector 2.025, checking quality -2.75, packaging- 2.375 , Sewing-2.02 ,sizing- 2.17 ,threading-2.3 ,transporting-2.It was found that wrist was at higher risk in checking quality.

Graph 14- risk factor of total REBA SCORE

Above graph shows that among various sectors in cotton textile industry total REBA score mean value.. Cutting sector -5.475(indicates posture is at medium risk and further investigation is required),checking quality -7.7(posture is at high risk an investigation is necessary to develop required changes),sewing-5.6 (indicates posture is at medium risk and further investigation is required),transporting-11(indicates posture is at very high risk an immediate change is required),threading-6 (indicates posture is at medium risk and further investigation is required),packaging-6.075 (indicates posture is at medium risk and further investigation is required) Sizing-10.6(indicates posture is at very high risk an immediate change is required). Transporting and Sizing was at very high risk of musculoskeletal disorders that requires immediate implement. Trunk was at higher risk among all sectors.

DISCUSSION

Work related musculoskeletal Disorders is one type of biomechanical hazards due to high force, repetitive and awkward posture.50–70% individuals developed WMSDs when exposed to poor working environments during working for the job which was estimated by WHO. Hence Purpose of this study was to find out risk of musculoskeletal disorders due to posture working in various sectors of cotton textile industry using REBA and Kinovea software.

T.Sakthi Nagaraj et.al performed a study in female sewing machine operators performing there task in standing posture and concluded that standing sewing operators significantly related to increase musculoskeletal symptoms and discomfort in different body parts which indicated 95.5% are at medium risk ,6.7 % at high risk and 1.8 % at very high risk .Present study tried to find out risk factors in male standing machine operators working in cutting , checking quality of textile ,sizing the goods, threading ,Packaging ,sewing and transporting the final textile and it revealed that 20% were at very high risk of MSDs which were majorly involved in Sizing and transporting where as 80% were at moderate risk which were involved in other sectors.

In previous study which was only in sewing female operators neck score of operators was 1, trunk - 2, leg -3, lower arm and wrist -1 and total grand score was 4-7 on REBA where as in present study in sewing male operators neck-2, trunk- 3 leg -1 lower arm -2 wrist -2 and total grand score-5 to 6 this change could be due to variation in working station. There is no previous literature on other sectors of industry like cutting, sizing, transporting, threading, packaging and checking quality by this study it states that this sectors are also at risk of MSDs with trunk getting highly involved.

P-C Wang et. al conducted a study to find out association of work organisational and personal factors associated with upper body disorders among sewing machine operators and it concluded that personal factors and work organisational factors are associated with increased prevalence of upper body WMSDS hence present study included the sample of age group 21-45, BMI -18.5 -24.9 Kg/m^2 so as to exclude the age related disorders and purely find out the risk of MSDs due to work related posture.

Balasubramian et. al states that prolonged standing for different task has high occurrence of risk in lowerlimb and back but this study highlighted that along with trunk and lowerlimb even upper body was also at risk with wrist being majorly involved due to fine repeated activities and upper arm due to heavy lifting which was in case of transporting the textile.

Diana et. al aim to find out association of individual and work-related risk factors with musculoskeletal symptoms among Iranian sewing machine operators which was performed in sitting posture it was found out that number of hours worked per day, duration of continuous work without a break, feeling pressure due to work, and working posture that was assessed by the RULA , as well as individual factors including age, gender, BMI and being involved in regular sport and physical activities were significantly associated with the presence of musculoskeletal symptoms of different body regions. Whereas this study also states that relationship of working history with all sectors of cotton textile industry working in standing posture with CI- 0.8382 (0.1791-3.9253) , Relationship between all the work sectors and musculoskeletal disorders Odd's ratio(CI) -68.5354 (4.2061-2313.0761).

Isa Halim et.al reported that there was difficulty in examining the body angle accurately by using RULA worksheet hence leads to inaccurate assessment. While RULA-KinectTM system is purposely developed to perform a postural assessment at actual workstations and tasks that will counter all the limitation of the RULA worksheet. But RULA Kinetic system was too expensive so in this study Kinovea software was used to measure the accurate angle and to reduce the observational error. Vijayendra Rajguru et.al evaluated risk of work related musculoskeletal disorders in professional architect by using REBA and Kinovea software.

This study concluded that there is significant relationship of working experience with WRMSDs as well as there is significant relationship with all the sectors of cotton textile industry with risk of MSDS. It was found out that trunk was at higher risk in sizing, cutting, threading, packaging, sewing while upper arm was at higher risk in transporting

CONCLUSION

This study found out that workers in cotton textile industry are at risk of MSDs due to prolong and repeated posture adapted by them. Workers involved in the sizing and transporting were at very high risk of MSDs hence immediate changes is needed. Where as workers working in sewing, threading, cutting, packaging and checking quality are at moderate risk and hence investigation is required. Trunk is highly at risk among all body segment followed by wrist, neck, leg, upper arm and lower arm.

LIMITATION

Few industries with various sectors were included.

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