PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISORDERS AND ITS RISK FACTORS AMONG COMPUTER WORKERS

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Abstract

Aim: This study aims to investigate the Prevalence of Work related Musculoskeletal Disorder (MSD) and its risk factors among Computer workers.

Background: Musculoskeletal disorder in human may originated from biomechanical, environmental, and personal risk factors encounter in working environment. During the last 2-decade information technologies in occupation activities have been developing very rapid. Musculoskeletal disorders have been common complaint among workers involved in static work or task requiring the repetitive motion of upper limb and prolong computer work. This study aims to assess the prevalence of Musculoskeletal Disorder (MSD) and its risk factors among Computer workers

. **Material & Method:** This cross-sectional study was conducted on 62 computer workers including 47 male & 15 females in Godavari foundation, Jalgaon. Data on MSD were received from Nordic Musculoskeletal Questionnaire (NMQ) while ergonomic data collected through Rapid Upper Limb Assessment (RULA). The data were analyzed using SPSS software 26 version, statical analysis was performed with Parsons's correlation coefficient.

Results: The results showed that highest prevalence rate of WRMSD were found in lower back (79.03%), and neck (69.35%). the results of postural assessment showed that 62.90% of participants require further investigation in order to modify their posture and 33.87% need to 'modify their posture soon'. the body mass index was also found as significant for musculoskeletal pain in various musculoskeletal region. Results also revealed that there is significant correlation between MSD in Lower back and Neck with RULA score. The Pearson test showed a positive significant correlation between RULA and NMQ score ($P<0.05$)

Conclusion: The study thus concluded that there is high prevalence of discomfort in lower back and Neck. Also, there is significant correlation between awkward posture and development of musculoskeletal discomfort. It is recommended that there should be proper ergonomic workshop for workers to be aware of ergonomic factors in the office.

Keywords: Musculoskeletal discomfort, RULA (Rapid upper limb assessment), NMQ (Nordic musculoskeletal questionnaire).

INTRODUCTION

Work related musculoskeletal disorders have been described as the most notorious and common causes of long-term pain and physical disability that affect millions of people across the world and it is an umbrella term for which repetitive strain injury, repetitive trauma discomfort and cumulative trauma discomfort are all used interchangeably. It represents a major economic burden on society in terms of decrease productivity and personal suffering.[20]

Musculoskeletal disorders (MSD) are injury /pain in the human musculoskeletal system including joint, ligament, muscle, nerve, tendon and structure that support limb, neck and back.

MSD are work related when work environment, procedure, performance of work is significant contributor to their development or exacerbation. WRMSDs describe a wide range of inflammatory and degenerative disease conditions that result in pain and functional impairment affecting the Neck, Back, Shoulder, Elbow, Wrist and Hand. Moreover, the WRMSDs are defined differently in different study some restrict the case definition base on clinical pathology, some explain due to symptoms and some due to objectively demonstrable pathological process and some due to work disability.[1,2]

The basic risk factors that contribute to work related musculoskeletal disorders are repeated manipulation of objects, sustain sitting in fix posture, long lasting physical inactivity, exposure to physical environmental factors. When professional in expose to MSD risk factors they begin to fatigue, when fatigue outrun their body's recovery system, they develop musculoskeletal imbalance.[3,12]

Awkward posture is defined as the deviation of a body part from its natural or 'neutral' position while job tasks are being performed (NIOSH, US). These postures typically include reaching behind, twisting, working ahead, Wrist-bending, kneeling, stooping and squatting. Such postures are usually related to injuries raised during tasks that are static in nature and relatively long lasting and during tasks that demand exertion of force.[9]

As we know, static work attitude potentially accelerates the onset of fatigue and pain in muscles involved. If these conditions take place every day and for a long time (chronic) pain can cause permanent damage to the muscles, joints, tendons, ligaments and other tissues. In addition, working with pain can reduce the productivity and efficiency of work and when working with this pain is continued then it will result in a disability, which ultimately eliminates the job for the worker.[1,]

Studies have shown that awkward posture is strongly associated with the development of musculoskeletal problems. Kilbom reported that workers with forward flexion of the neck and raised arms had a higher risk of MSDs than those not performing these movements. Postural analysis can be done using different technique. Among all the technique RULA is reliable and valid for evaluating the posture which involve upper limb.

Today's society pride themselves and they believe that technical advancement in information processing will enhance quality of life for all individuals. Computer use is prevalent in many workplaces, they can increase speed and accuracy of many processes, which improve workers efficiency. During the last two decades, computer use has rapidly increased. In 2000, 80% of workers stated that they use computers in their daily activities. As of 2020, India's IT workforce accounts for 4.36 million employees and accounted for 8% of India's GDP in 2020.

Musculoskeletal disorders have been common complaints among workers involved in static work or task requiring the repetitive motion of upper limb and prolonged computer work. Approximately 76% of computer professional from India report MSK discomfort in various epidemiological (Talwar Rel, 2009, Sharma A et.al, 2006).

Visual display terminal (VDT) workers are susceptible to development of musculoskeletal symptoms with prevalence as high as 50% (Here and Marcus, 2002).[1]

In developed countries, many studies have focused on this problem but only a few studies have been done in India. A study by Shrivastava & Bobhate revealed that 63% of the study subjects have Musculo skeletal problems.4 Another study conducted at Loni, Maharashtra by Giri et al has found Musculo skeletal problems in73.3% of the study subjects. Sivaraman et al have observed Musculo skeletal discomfort in 75.5% of the study population.

Ergonomic workplace design is one form of adjustment means for humans, and if the

design of the workplace is not in accordance with ergonomic principles, the workers would require extra exertion to carry out his work. The facilities used, including chairs and tables, can affect the posture of computer operators to become less ergonomic.[23]

This study helps to enhance proper intervention to prevent exposure to musculoskeletal discomfort such as ergonomic intervention in their working environment. And to make person aware of being physically active in order to minimize their health problems i.e., musculoskeletal discomfort. It also helps to ensure job efficiency and quality of life among office workers. So present study will find out the prevalence of work-related musculoskeletal disorders and its risk factors among computer workers in Godavari Foundation, Jalgaon.

METHODOLOGY

- **Material**
  - pen
  - pencil
  - other stationary things
- **Population size** - 62
- **Study place** - Godavari Foundation, Jalgaon
- **Study design** - Cross sectional study
- **Sampling Method** - Convenient Sampling
- **Study duration** - 6 Months
- **Outcome measure** - Standard Nordic musculoskeletal questionnaire
  - Standard RULA questionnaire
- **Selection Criteria**
  - **Inclusive criteria**
    - Computer workers
    - Age 20-50
    - Both male and female
    - Experience >1 year
  - **Exclusive criteria**
    - Subject who will not be willing to take part
    - Postural deformity

- Recent injury/trauma
- Neuromuscular discomfort
- Spinal surgery
- Pregnancy

METHOD

Participants: The study participants were employees at Godavari Foundation in Jalgaon. A total 62 office workers (Including 15 women and 47 men) with age ranging 20-50 years participated in survey. Participants worked an average of at least 7 h per day, five days a week at an office computer station and had been employed in this position for at least a year. The participants signed an informed consent form, and the study's procedures were approved by the Dr Ulhas Patil College of Physiotherapy, Jalgaon.

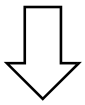
Procedure: In this study, the data were collected with questionnaires and by direct observation. In order to determine the prevalence of MSDs in different limbs of the workers, the Nordic questionnaire was used. The questionnaire assessed about the history of the experience of MSDs in nine body sites (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees and ankles/feet) over the past weeks and over the past year. Ergonomic risk factors were assessed through direct observation of the subject's postures by means of the RULA.

The RULA measure for office workers which quantifies the grade of the musculoskeletal risk of the sitting posture on a 1–7 scale was used to analyze the posture of the body. Higher RULA scores indicate high levels of risk factors causing load on the structures of body parts. The grade is calculated based on the degree of angles between various body parts and their recommended postures according to criteria derived through interpretation of previous relevant studies.

Statistical Analysis: Descriptive statistics of the general characteristics, work, and ergonomic risks of the study population were presented as numbers, percentages, and mean ± standard deviation. Prevalence of WMSD of each body segments (Neck, Shoulder, Elbow, Wrist, Hip, Back, Knee, and Ankle) was determined by NMQ for office workers. In order to understand which ergonomic risk factors with RULA relate to MSDs, Pearson's correlation coefficient was used. SPSS version 26 used for all static analysis with significance set at <0.05.

PROCEDURE

Permission from Ethical Committee



Subjects were selected according to selection criteria

Informed consent

Subjects were provided with questionnaire and information was collected.

Statistical Analysis were done and results were calculated

Data Analysis

Table 01: Gender, Ideal Posture, BMI Analysis

Characteristics	No.	%
Gender :		
Male	47	75.8
Female	15	24.19
Knowledge about Ideal Posture :		
Yes	42	67.74
No	20	32.25
BMI		
< 18.5	5	8.06
18.5 - 24.9	36	58.06
25 - 29.9	18	29.03
30 - 34.9	3	4.83
35 - 39.9	0	0
> 40	0	0
Age	Mean +- SD	34.11+-9.50
Time spend on work	Mean +- SD	8.10+-0.82

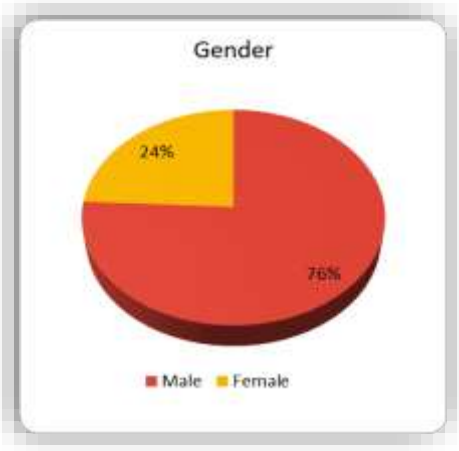
- Gender Distribution

Table 02: Gender Distribution

Male	Female
47 (76%)	15 (24%)

The Pie chart show gender distribution in our study 24% subjects were female and 76% subjects were male.

Graph 01: Gender Distribution Analysis



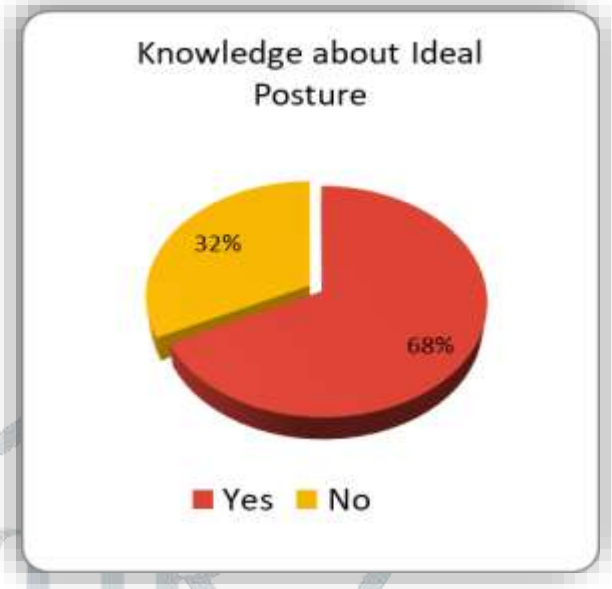
- Knowledge about Ideal sitting posture

Table 03 : Knowledge about Ideal Posture

Yes	No
42 (68%)	20 (32%)

The Pie chart show knowledge about ideal posture in our study 68% subjects were responded YES while 32% subject responded NO.

Graph 02 : Ideal Posture Knowledge Analysis

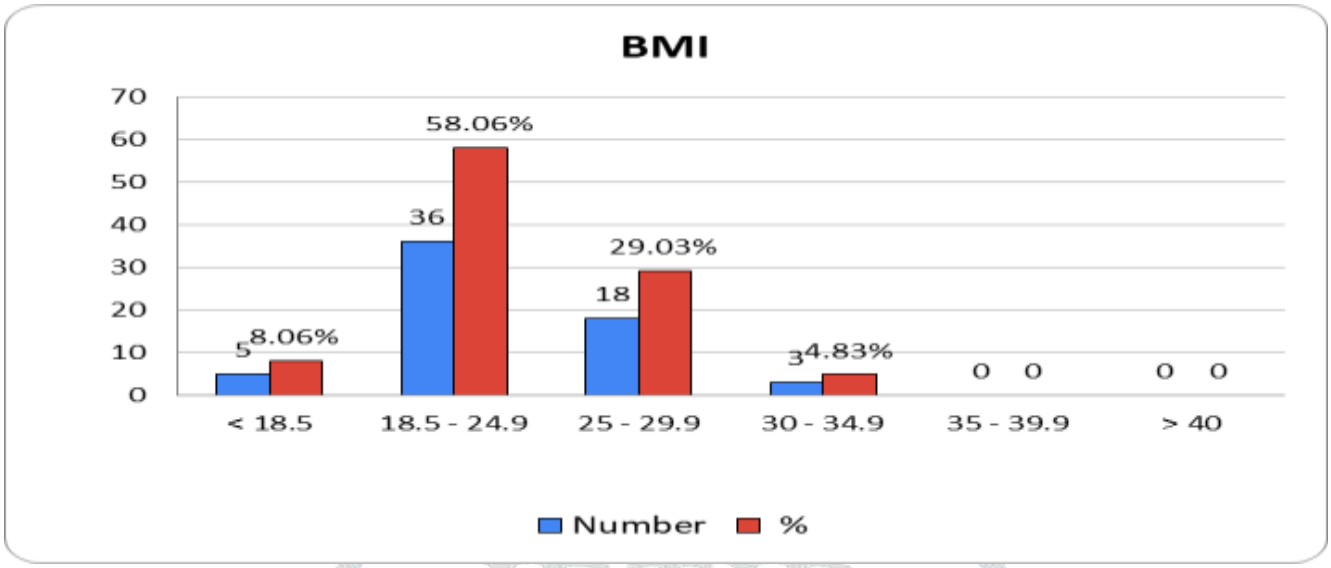


- BMI Analysis

Table 04 : BMI Scale & Analysis

BMI Scale	No.	%
< 18.5	5	8.06
18.5 - 24.9	36	58.06
25 - 29.9	18	29.03
30 - 34.9	3	4.83
35 - 39.9	0	0
> 40	0	0

Graph 03 : BMI Analysis



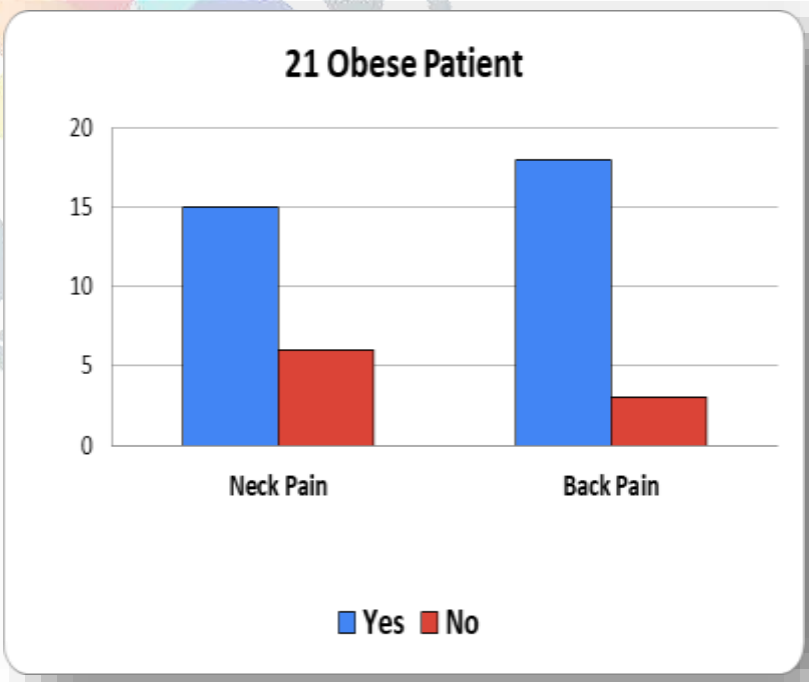
The Bar graph show 21(33.86%) subjects were under category of Overweight among them 3(4.83%) subjects were under category of Obese Class 1

- Obese Patients with MSDs

Table 05 : Obese Patient Analysis

21 Obese Patient	Neck Pain	Back Pair
Yes	15	18
No	6	3

The Bar graph show among 21 obese patients 15 patients' complaint of Neck pain while 18 patients' complaint of Back pain.



Graph 04 : Obese patient analysis

RESULTS

A. Prevalence: A total 62 participants (Male 76%, Female 24%) responded to the survey. The highest prevalence rate of MSDs was in the lower back (79.03%), neck (69.35%) and shoulders area (33.87%) and the lowest prevalence rate of MSDs was in elbows (9.67%) and ankle area (25.8%). The findings from this study also revealed that 93.5% of the subjects had experienced MSDs over the last 12 months. Table 06 presents the results of the Nordic questionnaire.

The result of the postural analysis, enlisted through the RULA approach, showed that 3.22% of participants were under action level 1, which indicates posture is acceptable if it is not maintained or repeated for prolonged periods. 62.9% of participants were under action level 2, which requires further investigation and changes may be required and 33.87% of participants were under action level 3, which indicates that changes are needed soon (Table 07).

Table 06 : Nordic questionnaire results (n=62)

Area of body affected	Occurrence in last 12 months	
	Number	(%)
Neck	43	69.35
Shoulders	21	33.87
Elbows	6	9.67
Wrists/Hands	25	40.32
Lower back	49	79.03
Hip/Thigh	27	43.54
Knee	27	43.54
Ankle/Feet	16	25.8

Graph 05 : Nordic questionnaire results (n=62)

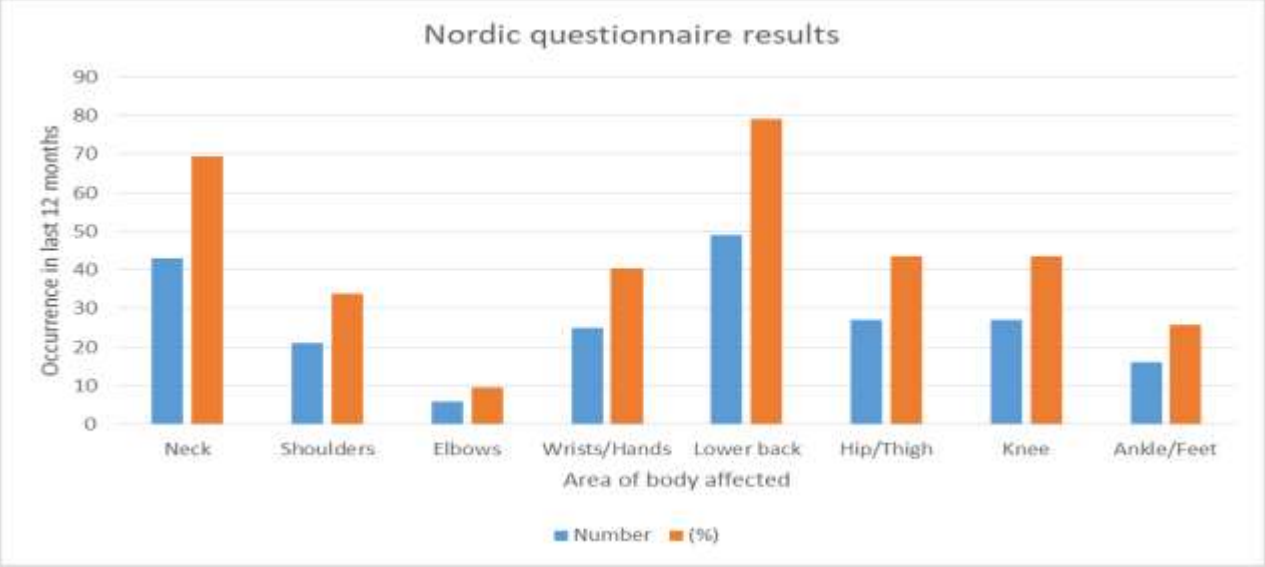
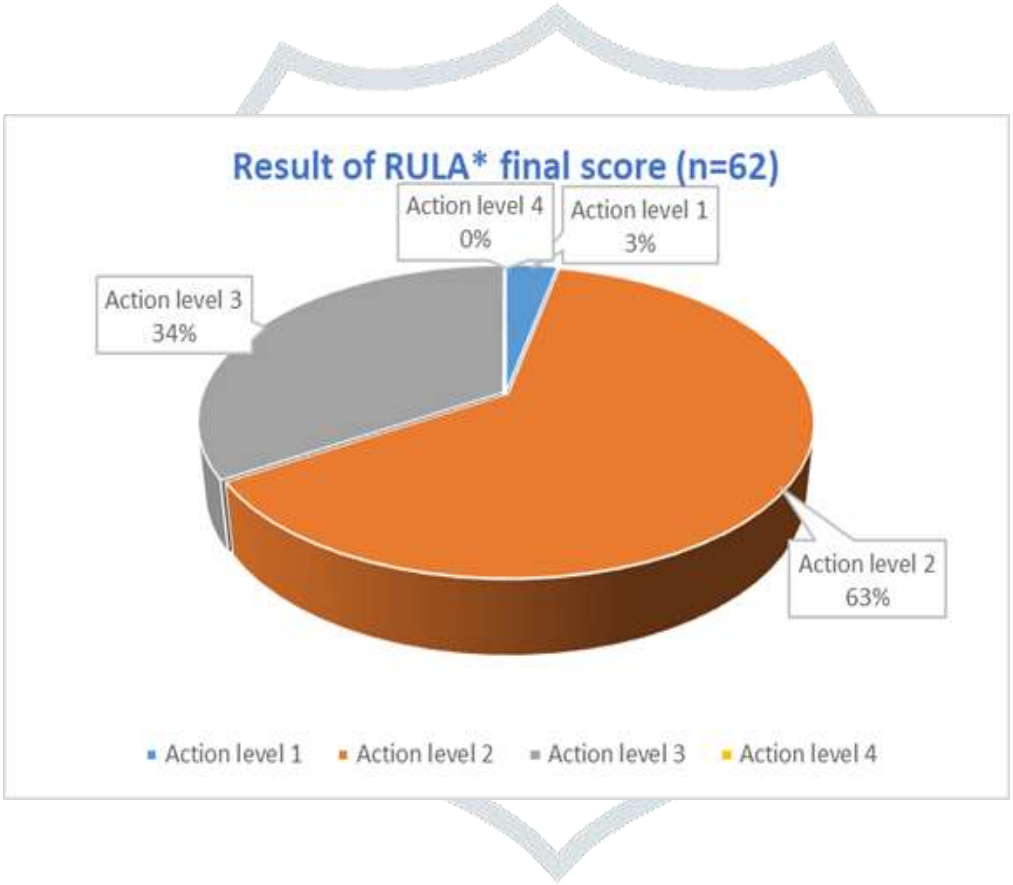


Table 07 : Result of RULA* final score (n=62)

Action level	No.	%
Action level 1	2	3.22
Action level 2	39	62.9
Action level 3	21	33.87
Action level 4	0	0

Graph 06 : Result of RULA* final score (n=62)



The Pie chart showed that 3.22% of participants were under action level 1, which indicates posture is acceptable if it is not maintained or repeated for prolonged periods. 62.9% of participants were under action level 2, which requires further investigation and changes may be required and 33.8% of participants were under action level 3, which indicates that changes are needed soon.

Correlation

Table 8 present association between MSD and RULA score of (Neck, Shoulder, Elbow, Wrist, Back, Hip, Knee, Ankle) and RULA final score. Correlation analysis showed that MSD in Wrist area was significantly correlated with RULA C score (r=0.384, p=0.002), MSD in Shoulder area was significantly correlated with RULA C score (r=0.263, P=0.039), MSD in Neck area was significantly correlated with the RULA D score (r=0332, P=0.008) and MSD in Low back area was significantly correlated with RULA D score (r=0.309, P=0.014) and RULA final score (r=0.294, P=0.020).

Table 8 : Relationship between RULA risk factors and musculoskeletal disorders

Body Area	C Score	D Score	Final Score
NECK	r = 0.071 p=0.584	r = 0.332 p=0.008*	r = 0.239 p=0.062
SHOULDER	r = 0.263 p=0.039*	r = -0.017 p=0.893	r = -0.063 p=0.625
ELBOW	r = 0.274 p=0.031*	r = -0.150 p=0.245	r = -0.111 p=0.390
WRIST	r = 0.384 p=0.002*	r = -0.072 p=0.576	r = 0.002 p=0.988
LOWER BACK	r = 0.185 p=0.150	r = 0.309 p=0.014*	r = 0.294 p=0.020*
HIP	r = 0.025 p=0.847	r = -0.024 p=0.856	r = -0.046 p=0.720
ANKLE	r = -0.071 p=0.583	r = -0.046 p=0.723	r = -0.086 p=0.504
KNEE	r = 0.077 p=0.553	r = 0.173 p=0.180	r = 0.148 p=0.251

RULA = Rapid upper limb scale

C score = Score of arms, forearms and wrists posture + muscle use + force

D score = Score of neck, trunk and lower extremity postures + muscle use + force

* Indicates a significant correlation

DISCUSSION

The primary aims this cross-sectional study was to determine the frequency of musculoskeletal discomfort in computer workers and its association to some risk factors in office workers in Godavari Foundation. As it is commonly known, maintaining poor posture for prolong periods of time can result in chronic muscular fatigue, discomfort or pain. More significantly, prolonged exposure to high static muscle and joint load may lead the soft tissue to adaptively change, and with time may lead to pathological effect and permanent disability. The results of the current study showed that these computer workers had both a high level of MSDs as well as high ergonomic risks.

In this study, 93% of employees experienced MSDs at least in one extremity due to poor posture imposed by their workstation conditions. Studies revealed that awkward posture leads to the development of musculoskeletal discomforts. In the current study, the working posture of the office workers most of the cases was at Action level 2 and 3 which indicate the changes may be required. In the present study, back pain was most frequently reported whereas 79% (n= 49) of the subjects had experience such problem in the past 12 month and 69% (n=43) of subject's complaint of neck pain. This 12- month prevalence value for back pain 79% corresponds closely to the findings of previous studies which reported that annual prevalence of back pain was measured as 72.4% (Fariborz et al., 2018). Further the reported prevalence rate of neck pain in present study was considerably higher than the 38.6% value found by (Rajinder et al., 2015).

The continue movements of flexion or rotation of the cervical spine can direct to discomfort in the neck and shoulders. At the level of the neck and in the trapezius muscle region, it is known that there is a positive relationship between the flexion of the neck and discomfort in this region as well as in the lumbar spine, whose combined movement of flexion and rotation of the trunk and forced movements are related to the presence of discomfort.

Along with awkward posture, also BMI and its relationship with musculoskeletal discomfort were interpreted. A BMI of >25kg/m2 was found to associate with musculoskeletal pain in Neck and low back anatomical region and this is in agreement with other epidemiology studies.

A higher prevalence of lower back, neck, and shoulders MSDs in computer workers was caused by faulty body posture and inappropriate workstations. Therefore, employees' postures at their workstations needed to be investigated and some changes were required immediately. It is essential that ergonomic programs and workstation exercises for the computer workers in the study population be put into action immediately and medical treatment for those with high symptomatic and risk levels be provided.

Our suggestions for future studies include association of different examination of risk assessment, demographic data and musculoskeletal discomfort. To obtain more accurate results, we recommend using combination of method (Pen paper observational method as well videotaping observational method) for posture analysis. We can also correlate other risk factors with musculoskeletal discomfort.

CONCLUSION

The study showed a high prevalence of discomfort in Lower back, Neck followed by Shoulder, Wrist. The office workers participate in this Study were found to have high level of both MSDs and Ergonomic risks. The Study also highlighted the correlation between RULA postural score and muscular disorders in various body parts. Therefore, it is essential to perform ergonomic corrective action in order to improve the physical condition of their working environment and prevent work related musculoskeletal disorders.

LIMITATIONS

- Posture analysis was carried out only by observational method.
- Only body mass index was taken as outcome measures for obesity.
- The study was restricted to only Godavari Foundation, Jalgaon.

FUTURE SCOPE

- We may include some objective assessment of workstation as well extended demographic questions including health insurance status.
- We can obtain association between demographic data, complaint and examination of risk assessment.
- To obtain more accurate results, we recommend using combination of method (Pen paper observational method as well videotaping observational method).
- We can correlate other risk factors with musculoskeletal discomfort.

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