

# Prevalence of Musculoskeletal Problems in Plastic Industry Workers

Manasi Desai<sup>1</sup>, Trisha Vinekar<sup>2</sup>

<sup>1</sup>M.P.Th in Neurosciences, Department of Neurophysiotherapy, Assistant Professor, D.Y.Patil University, School of Physiotherapy, Nerul, Navi Mumbai, Maharashtra

<sup>2</sup>B.P.Th, D.Y.Patil University, School of Physiotherapy, Nerul, Navi Mumbai, Maharashtra

Corresponding Author: Trisha Vinekar

## ABSTRACT

**Aim:** The purpose of the study was to identify the prevalence of musculoskeletal problems in plastic industry workers.

**Methodology:** A cross sectional survey was conducted on 100 plastic industry workers by administering the Extended Nordic Musculoskeletal Questionnaire to quantify the musculoskeletal pain and activity limitation in 9 body regions. A Self-Designed Questionnaire was also administered which aimed at getting information regarding the various musculoskeletal problems faced by the workers, work-related risk factors, various postures attained and activities performed throughout the day.

**Results:** Out of 100 workers investigated, 73 workers experienced musculoskeletal pain. Lower back (37%), shoulders (19.2%) and wrists (13.7%) were the most commonly affected body regions. The results showed that the work-related risk factors like frequent bending and twisting (34%), repetitive and forceful motions (17%), manual handling (13%) and awkward postures were highly associated with musculoskeletal disorders.

**Conclusion:** The study concludes that there was 73% prevalence of musculoskeletal problems in plastic industry workers. Lower back was the most commonly affected body region followed by shoulder, wrists and knees. Majority of the workers were required to perform tasks which involved frequent bending and twisting of the trunk which have contributed to the high prevalence of work related musculoskeletal disorders in this population. The study also concluded that the implementation of ergonomic intervention strategies at the workplace may eliminate ergonomic hazards and minimize the risk of work-related musculoskeletal disorders.

**Key Words:** Work-related musculoskeletal disorders, Extended Nordic Musculoskeletal Questionnaire, Ergonomic hazards

## INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are outlined as a set of musculoskeletal disorders that arise from occupational exposures. WMSDs incorporate an extensive range of inflammatory and degenerative conditions affecting the musculoskeletal systems and can occur from any traumatic event or cumulative overuse injuries. Hence, this group of disorders represents one of the most common occupational health problems

in the working population. WMSDs cause chronic pain and functional impairment and can affect the quality of life, thus resulting in increased sick leaves or early retirement and can impose a major economic burden due to compensation costs and lost wages. [1]

Work-related musculoskeletal disorders are more likely in work sectors that have complex ergonomic hazards and employ large numbers of workers. [2] Some of the most common factors of ergonomics

that lead to musculoskeletal disorders are awkward postures and a heavy exertion workload. Improper posture and heavy physical demand while performing a task can cause musculoskeletal disorders: in particular, tasks that need lifting activity and pulling or pushing tasks in various sectors such as manufacturing industries. [3] Without the application of ergonomic principles, workers are often forced to adjust themselves to poor working conditions. [4] Poor working conditions such as repetitive bending while lifting objects, twisting and pulling or pushing of heavy objects, are all wide range of poor postures that can lead to a significant impact on execution as well as postural stresses. [5] It is likely that many workers who are in active employment have musculoskeletal disorders expressed as pain or discomfort. Due to unavailability of proper medical aid at workplace, the workers continue to work with pain. Thus repetitive injuries can develop over time and can lead to long term impairments.

Work-related musculoskeletal disorders have become increasingly common in industrial population. Various industries that are prone to musculoskeletal disorders are as iron, [6] steel, [7] metal, [8] coal, [9] plastics, [10,11] industries etc. One of the groups which maybe prone to musculoskeletal disorders are the plastic industry workers. The day to day tasks of plastic industry workers require weighing and mixing raw materials, feeding materials into the machine, monitoring production, trimming the excess plastic from products, fixing, cutting, labelling, stocking and packaging. The plastic industry workers typically require the adopting of awkward postures such as lifting of heavy loads, manual handling, frequent bending and twisting of the body, staying in a static posture for a long period, and other repetitive physical demands. Because of such strenuous work type involved, the workers usually fail to implement ergonomics in their activities and are at risks of various musculoskeletal problems. This may result in damaging physiological

changes that can lead to pain. If regularly occurring pain or discomfort is ignored, the physiological damage can lead to an injury.

Rita de Cassia Pereira Fernandes et al., [10] studying the industrial population of plastic industry workers in Brazil, found an overall prevalence of musculoskeletal pain of 50.1%. The prevalence of musculoskeletal disorders was high in the lumbar region (28.9%), neck (27.4%), shoulder (17.6%) and distal upper extremities (18.7%). The study reported that a greater exposure to repetitive hand movements, working in static posture (standing more than seated) and load lifting were associated with musculoskeletal disorders. Another study by Rita de Cassia Pereira Fernandes et al., [11] also reported that there was a greater probability of neck, shoulder and upper back MSDs occurrence among the workers who were more exposed to physical demands related to manual handling which not only incorporated load lifting but also working with arms above shoulder level and muscular exertion with arms and hands. M Aghilinejad et al. [7] reported that lumbar, knees and neck were the most commonly affected areas in Iranian steel workers and the study observed a high prevalence due to awkward working postures, manual material handling and long hours of standing work.

Globally, a few studies have investigated the musculoskeletal problems faced by plastic industry workers, [10,11] but there is a paucity of studies on this subject in India. Thus the purpose of the study was to find the prevalence of musculoskeletal problems in plastic industrial workers. The study also aims to complement the knowledge of the severity of work related disorders with the sole purpose that the information may be useful for developing viable strategies towards minimizing industrial injuries.

## **MATERIALS AND METHODS**

A cross sectional survey was carried out among 100 plastic industrial workers in the age group of 20-60 years over 6 years of

experience. A study was conducted by administering a Self-Designed Questionnaire aimed at getting information regarding the various musculoskeletal problems faced by plastic industrial workers, work-related risk factors and various postures attained and activities performed throughout the day. The Extended Nordic Questionnaire was also used to quantify the musculoskeletal pain and activity limitation in 9 body regions.

**RESULTS**

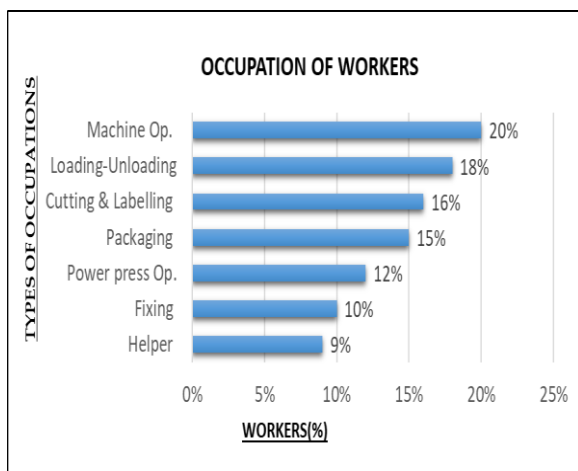


FIGURE 1: OCCUPATION OF WORKERS

**INFERENCE:** Out of 100 workers, 20% were Machine Operators, 18% were under Loading- Unloading, 16% were in Cutting & Labelling, 15% in Packaging, 12% were Power Press Operators, 10% in Fixing and 9% were Helpers.

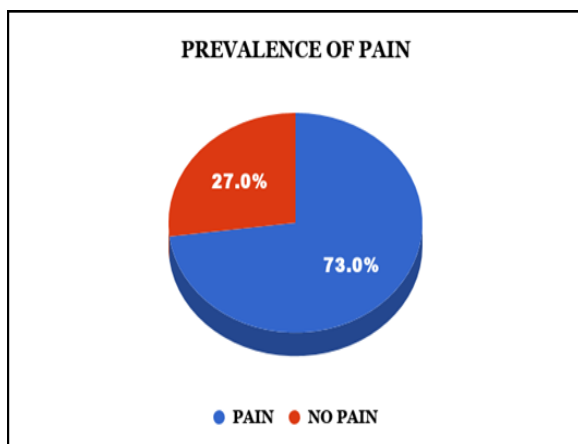


FIGURE 2: PREVALENCE OF PAIN IN WORKERS

**INFERENCE:** 73% of workers experienced pain after they started working in the industry.

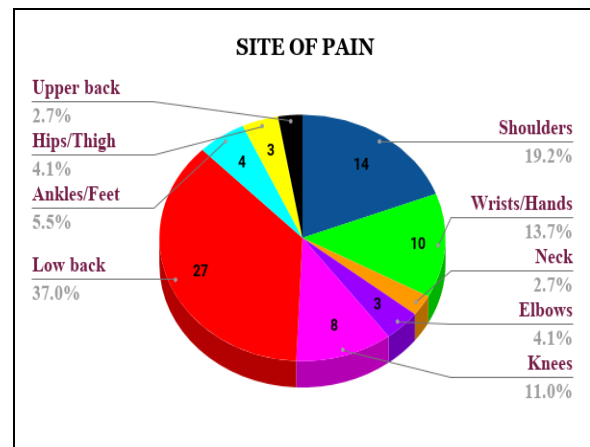


FIGURE 3: INVOLVEMENT OF SITE OF PAIN

**INFERENCE:** Out of 73% of workers who experienced pain, 37% had low back pain commonly affected, followed by shoulders (19.2%), wrists/hands (13.7%), knees (11%) along with ankles/feet (5.5%), elbows (4.1%), hips/thigh (4.1%), neck (2.7%) and upper back (2.7%) which were least affected.

**NATURE OF WORK (Occupation wise)**

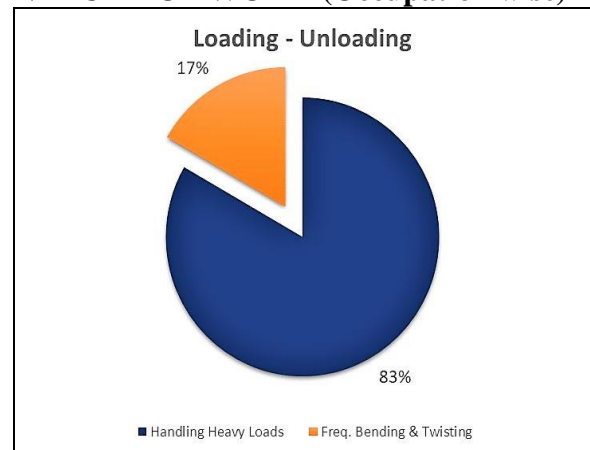


FIGURE 4: WORKERS IN LOADING & UNLOADING

**INFERENCE:** Maximum (83%) workers required handling of heavy loads while 17% of workers required to perform frequent bending & twisting.

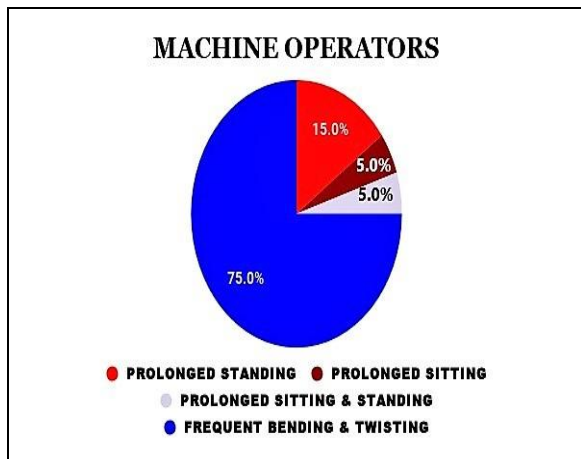


FIGURE 5: MACHINE OPERATORS

**INFERENCE:** Maximum (75%) machine operators required to perform frequent bending and twisting

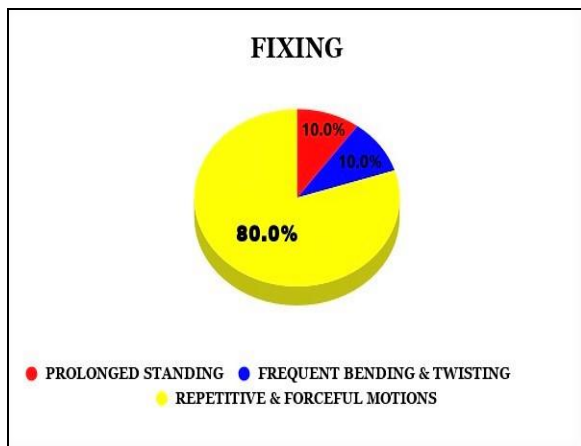


FIGURE 6: WORKERS IN FIXING DEPT.

**INFERENCE:** Maximum (80%) workers in fixing department, required to perform repetitive & forceful motions followed by 10% required to perform frequent bending and twisting and 10%

All the workers in cutting & labelling required to perform repetitive & forceful motions whereas all the workers in packaging required to perform frequent bending & twisting while the helpers required to perform frequent lifting.

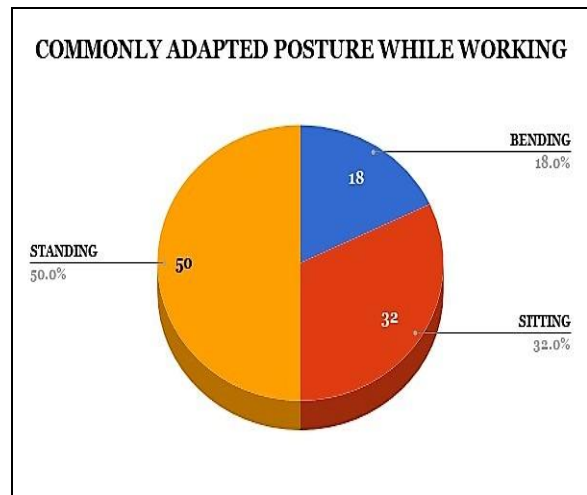


FIGURE 7: COMMONLY ADAPTED POSTURE AT WORK

**INFERENCE:** Maximum no. of workers i.e. 50% adapted standing posture while working while 32% adapted sitting posture.

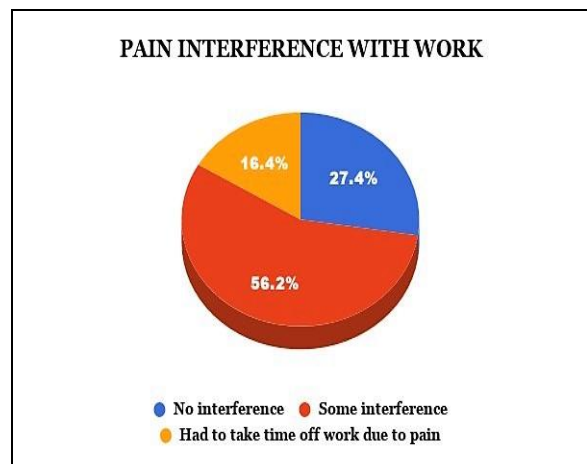


FIGURE 8: INTERFERENCE OF PAIN WITH WORK

**INFERENCE:** 56.2% of workers had some interference of pain at work while 16.4% had to take time off work due to pain.

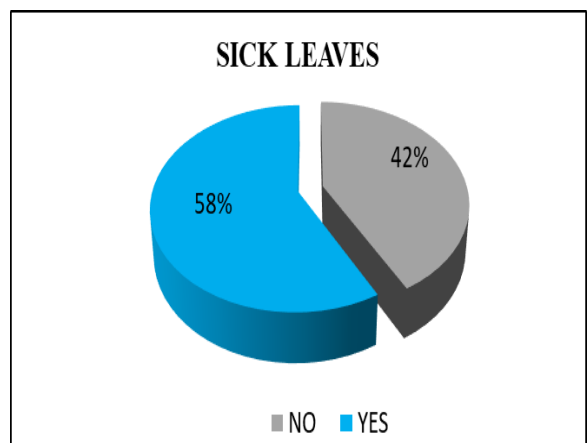


FIGURE 9: NEED FOR A SICK LEAVE

**INFERENCE:** Majority (58%) workers needed to take sick leaves during last 12 months.

## DISCUSSION

The purpose of our study was to find out the prevalence of common musculoskeletal problems among the workers in plastic manufacturing industries. The study was done based on the data collection done through the questionnaire from the workers of plastic manufacturing industries. This survey was performed on one to one interview basis. This study analyzed data collected from 100 workers.

Amongst the 100 workers who participated in the study, all were males. The mean age of the subjects was 35.21 years with SD  $\pm$ 11.50 years. 91% were right handed by dominance and 9% were left handed. According to the Figure 1, about 20% were Machine Operators, 18% were under Loading- Unloading, 16% were in Cutting & Labelling, 15% in Packaging, 12% were Power Press Operators, 10% in Fixing and 9% were Helpers. Maximum number of workers i.e. 53% were working for more than 6 years. Majority of the workers i.e. 64% were working for 10-12 hours per day whereas 35% for 7-9 hours per day.

The primary objectives of our study were to study the prevalence of musculoskeletal problems faced by plastic industry workers and to identify the areas causing maximum pain. Prevalence of musculoskeletal problems in plastic industry workers was found to be quite high with 73% of workers reporting the presence of pain after they started working in the industry. This prevalence was higher when compared to the study conducted in Brazil [10] where the prevalence in plastic industry workers was found to be 50.1%. The overall prevalence of low back pain in the present study (37%) is comparable to 28.9% found among the plastic industry workers in Brazil. [10] According to the present study, this prevalence is higher in India than Brazil. It was found that majority of the

workers in India were required to perform tasks which involved frequent bending and twisting movements of the back. The workers reported lack of adequate breaks and unavailability of medical aid at work place. These factors may have contributed to the high prevalence of WMSD's in this population.

Out of 73% of workers who had pain, the most commonly affected area was low back (37%) followed by shoulders (19.2%), wrists/hands (13.7%), knees (11%) along with ankles/feet (5.5%), elbows (4.1%), hips/thigh (4.1%), neck (2.7%) and upper back (2.7%) which were least affected. [Figure 2 & 3]

Globally, 37% of low back pain is caused by occupation and work-related pain (Punnett et al.). [12] It may be associated with the potential risk factors identified with physical aspects of the workplace: (1) heavy physical work, (2) lifting and forceful movements, (3) bending and twisting, (4) static work postures. [13] Workers in industries have to work in various awkward positions and static postures for long duration with repetition of activities. [14] They have to adjust their postures according to the work assembly which includes bending, twisting the trunk, overhead activities, forward leaning postures, stooping, kneeling, manual handling of weights in awkward positions, pushing or pulling of weights. These high risk postures and postural deviations equally contribute to increasing their susceptibility to low back pain. [15]

The core muscle strength is one of the contributing component for low back pain. Core stability is important for maintaining an upright posture and particularly for movements that require additional effort such as lifting a heavy weight from the ground. Without core stability, the lower back is not supported which can result in low back pain and poor posture. Lack of flexibility in lower limbs especially in hamstrings, hip flexors and lumbar region due to prolonged sustained positions and lack of stretching has been

observed to be another contributing factor for low back pain. [14]

The second most affected area was shoulder. 19.2% of workers suffered from shoulder pain. Factors that may contribute to shoulder pain are muscle loading or working with hand at or above shoulder level. [16] The workers had to overexert themselves by lifting and carrying heavy loads above the shoulder level repetitively. Localized muscle fatigue, by all accounts, seems to be a relevant factor in the onset of shoulder pain which normally emerges as a consequence of sustained muscle contractions in varying work situations with the arms at or above shoulder level, repetitive elevations and generalized shoulder muscle load. [16] At the point, when the arms are elevated and unsupported the gravity creates a load which must be neutralized by the shoulder muscles. The shoulder load is highest at 90 degrees (Jensen et al). [17] The workers often work in situations aggravated by awkward posture and the use of heavy material loads.

About 13.7% workers reported with pain in wrists/hands. Probable reason could be repetitive motions and forceful exertions of the wrist which is required during cutting, labelling and packaging of products. Repeated movement at wrists and hand may lead to damage of the muscles, tendons and ligaments in the wrist [18] and cause disabling pain.

The third objective of our study was to determine the work related risk factors related to musculoskeletal disorders. A work-related risk factor is one among several factors (although not necessarily a sufficient factor) that cause, provoke, or aggravate a latent disorder (WHO). [19]

In the present study, it was found that 36% of workers were required to perform frequent bending and twisting, 34% required repetitive and forceful motions, and 17% required manual handling whereas 13% required lifting. The risk factors found in this study were similar to the study among the workers in semiconductor industry by Pocekay et al., [20] who found

frequent bending and twisting, awkward posture, repetitive work, manual handling and prolonged activities associated with musculoskeletal problems.

In this study, it was found that the workers were more exposed to frequent bending and twisting movements at work when compared to the workers in Brazil. [10] Frequent bending and twisting of the trunk, suggests the role of motion as a risk factor. A study by US Department reported that bending postures are associated with 56% of low back injuries, twisting or turning are associated with 33% of injuries. [21] This is because many individuals bend from hips and waist rather than the knees. This stretches the muscles and ligaments in the back, puts strain on muscles, and causes the discs between the vertebrae to move back. Strain at the back occurs when the muscles and ligaments that support the spine become stretched and weakened so they can't provide similar level of support. Strain can be caused by twisting awkwardly, stretching too far or lifting a heavy object incorrectly.

Manual handling includes carrying, holding, and pushing and pulling objects. In numerous epidemiologic studies manual handling has been identified as a risk factor for low back pain, and furthermore for shoulder disorders. [22] Typically, a two-to-threefold increase in risk of low back disorders has been found in occupations that involve manual lifting of heavy objects. Frequent lifting with extended arms, and twisting while lifting, is associated with an increase in risk. [23] Manual handling likewise incorporates exposures to risk factors other than the exertion of forces. In large number of studies, it is obvious that manual handling frequently induces static loads due to awkward postures. [19] In a review by Riihimaki et al., [22] the following work related risk factors for low back disorders were observed: heavy physical work, lifting, carrying, pulling, pushing, twisting, bending, other non-biased trunk postures, sitting.

Loads handled at low heights and at greater horizontal distances from the spine

incredibly increase the loading on the spine. This increased loading is due to two features. First, greater distance of the load from the spine increases the load moment, which requires greater internal forces to counterbalance the external load. These enlarged internal forces results in greater spine loading in each compression and shear. Second, lifting from low positions requires greater amount of the body mass to reach beyond the base of support for the spine. This increases the moment imposed about the spine due to the weight of the torso and distance of its center of mass in respect to the base of support for the spine. In addition, the supporting muscles should operate during a state of lengthened tension that is known to be one of the weakest positions of a muscle. In this way, risk is associated with greater loading of the spine as well as reduced muscular capability of the trunk muscles.<sup>[24]</sup>

The third risk factor found in the study was repetitive & forceful motions. In repetitive work, the same tasks are repeated for extended periods of time. Ordinarily, the work pace is rapid and the work requires frequent movements or exertions of the same body part.<sup>[19]</sup> Repetitive movements with awkward postures are hazardous when they involve the same joints and muscle groups, that is, when the workers do the same motion too often, too rapidly and for a really long time (Mehdi Ghasemkhani et al).<sup>[25]</sup> Repetitive work of the hand is a common problem at work, however other parts of the body also may be affected.<sup>[26]</sup>

Repetitiveness of work is characterized conceptually regarding the quantity of exertions per unit time and the ratio of work to rest. At the point when the recurrence of effort is too high or the recuperation time is too short, workers may encounter distress and impairment in performing their jobs. If the exposure to overexertion continues, tissue viability may be impeded, promoting further symptoms and reducing capacity. In extreme cases, activities at work and in daily living may be impaired. Epidemiologic studies have

generally found that carpal tunnel syndrome (compression of the median nerve in the wrist)<sup>[27]</sup> and tendon disorders in the wrist and forearm are related to repetitive manual work.<sup>[19]</sup>

The fourth objective was to study the various postures the workers adapt while working. From the figure 7, maximum number of workers, i.e. 50% of them adapted standing posture while working, followed by 32% adapted sitting while 18% adapted bending.

Standing for extended periods of time can cause the posture to become progressively worse. Typically, workers will begin to slump and shift their weight from one foot to another to mitigate strain. Slumping thus promotes a posture which is static and causes the worker to become less cautious and active. If the workspace is inadequate for the task, workers will have less freedom to move around and revive tired muscles. They may likewise be compelled to assume awkward positions. Prolonged standing leads to postural muscle fatigue. Muscles additionally require rest breaks to recover from episodes of work. Standing for a long time forces muscles and joints to work relentless without nourishment. Without rest, muscles become exhausted, resulting in pain.<sup>[28]</sup>

With prolonged sitting at work promoting constrained movement of muscles, most big muscle groups experience long phases of immobility. Prolonged sitting reduces the body movement making muscles become weak, more likely to pull, cramp and strain when stretched suddenly. Long periods of prolonged sitting prompt a poor posture which in turn causes fatigue in the back and neck muscles and puts high strain on the spine. With prolonged sitting if the head, neck and shoulders are not aligned in an almost straight line, then there are plenty of chances resulting pain in the back and shoulder muscles.<sup>[29]</sup>

The fifth objective of our study was to suggest corrective measures and bring awareness among them to minimize the risk of these problems. From the total study

conducted 73% of the workers had experienced pain. Application of ergonomic principles at the workplace is the best method for primary and secondary prevention and to provide appropriate work stations and healthy and comfortable working conditions to obtain maximum production with legitimate utilizations of resources. [18] Thus awareness about the musculoskeletal problems and its risk factors among the workers can play an important role in preventing work-related musculoskeletal disorders.

## CONCLUSION

The above study identified a high prevalence of work related musculoskeletal disorders among the workers of plastic industry. The results show that 73% of workers were working with musculoskeletal pain. Lower back, shoulder and wrists were the most commonly affected body regions. Most of the workers were exposed to ergonomic risk factors and were required to perform frequent bending and twisting of the trunk, repetitive movements and handling of heavy loads. Moreover, the workers work for prolonged period of time with inadequate breaks, remaining in constrained and static postures such as standing, sitting and bending which further amplified their discomfort feeling. Based on these results and taking into consideration the high prevalence of WMSDs, it is necessary to create awareness among the workers and to disseminate general recommendations for prevention of WMSDs with regards to ergonomic advice along with postural corrections and exercises which may help in minimizing the risk of WMSDs.

**Conflict of Interest:** The authors report no conflict of interest in this work.

## ACKNOWLEDGEMENTS

The authors would like to thank all staff members of the Physiotherapy department of D.Y.Patil Hospital, Nerul for their assistance in the conduction of this study. We are grateful to all our study subjects for cooperating with us in carrying out this study, as without them it would have been impossible to complete the study.

## REFERENCES

1. Hsin-Yi Kathy Cheng, Man-Ting Wong, Yu-Chung Yu and Yan-Ying Ju. Work-related musculoskeletal disorders and ergonomic risk factors in special education teachers and teacher's aides. BMC Public Health (2016). Academic Journal, Vol. 16, Issue 1, p1.
2. Jungsun Park, Yangho Kim, Boyoung Han. Work Sectors with High Risk for Work-Related Musculoskeletal Disorders in Korean Men and Women. Safety and Health at Work (March 2018), Volume 9(1).
3. Ling Lei, Patrick G. Dempsey, Jian-guo Xu, Lin-na Ge, You-xin Liang. Risk factors for the prevalence of musculoskeletal disorders among Chinese foundry workers. International Journal of Industrial Ergonomics (2005). Volume 35, Issue 3:197-204.
4. Shin-ichi Tanabe, Naoe Nishihara and Masaoki Heneda. Indoor temperature, productivity and fatigue in office task. Journal of HVAC & R Research 2007, Vol 13, Issue 4:120-135.
5. A.M. Trinkoff, J.A. Lipscomb, J. Geiger-Brown, C.L. Storr, B.A. Brady. Perceived physical demands and reported musculoskeletal problems in registered nurses. American Journal of Preventive Medicine 2003. 24(3):270-275.
6. Dhanjee Kumar Chaudhary, Ashis Bhattacharjee, Aditya Kumar Patra, Nearkasen Chau. Whole-body Vibration Exposure of Drill Operators in Iron Ore Mines and Role of Machine-Related, Individual, and Rock-Related Factors. Safety and Health at Work 2015, Volume 6. Issue 4:268-278.
7. M Aghilinejad, A R Choobineh, Z Sadeghi, M K Nouri and A Bahrami Ahmadi. Prevalence of Musculoskeletal Disorders among Iranian Steel Workers. Iranian Red Crescent Medical Journal. April 2012. 14(4):198-203.
8. Picoloto D, Silveira E. Prevalence of musculoskeletal symptoms and associated factors in workers from a metallurgical industry in Canoas - RS. Ciênc Saúde Coletiva 2008; 13: 507-16.
9. Guangxing Xu, Dong Pang, Fengying Liu, Desheng Pei, Sheng Wang and Liping Li. Prevalence of low back pain and associated occupational factors among Chinese coal miners. BMC Public Health 2012, 12(1):149.
10. Rita de Cássia Pereira Fernandes; Fernando Martins Carvalho; Ada Ávila Assunção. Prevalence of musculoskeletal disorders among plastic industry workers. Cadernos Saúde Pública 2011, Volume 27, Number 1, pp. 78-86(9).



11. Rita de Cassia Pereira Fernandes. Musculoskeletal disorders among workers in plastic manufacturing plants. *Revista Brasileira de Epidemiologia*, Vol.13 no.1:11-20, Sao Paulo Mar. 2010.
12. P. Paul F.M. Kuijer, Henk F. van der Molena, Monique H.W. Frings-Dresen: Evidence-based exposure criteria for work related musculoskeletal disorders as a tool to assess physical job demands. *Work*, vol. 41, no. Supplement 1, pp. 3795-3797, 2012.
13. Eriksen W, Natvig B and Bruusgaard D 1999 Smoking, heavy physical work and low back pain: A four-year prospective study *Occup. Med.* 49 155-160.
14. Bhakti Jamdade V, Apurv Shimpi, Savita Rairikar. Factors Predisposing to Work Related Low Back Pain in Automobile Industry Workers – A Hypothesis. *Journal of Medical Thesis*. Volume 3. Issue 2. May 10, 2015.
15. Noor Sazarina Mad Isa, Yahya, Baba Md Deros, Mazrura Sahani, Ahmad Rasdan Ismail. Physical activity and low back pain among automotive industry workers in Selangor. *Malaysian Journal of Public Health Medicine* 2014, Vol. 14 (2): 34-44.
16. Mario Pribicevic. The Epidemiology of Shoulder Pain: A Narrative Review of the Literature. October 24th 2012. InTech.
17. Therese Nordberg Hanvold. Mechanical workload and neck and shoulder pain at the start of working life. National Institute of Occupational Health, Oslo 2014.
18. National Health Promotion and Disease Prevention Objectives.
19. Thomas J Armstrong, Peter W Buckle, Kilborn Mats Hagberg, Marie Haring-Sweeney, Bernard Martin et al. Musculoskeletal Disorders: Work-related Risk Factors and Prevention. *International Journal Of Occupational and Environment Health*, Aug 1996, 2(3):239-246.
20. Pocekay, D., McCurdy, S. A., Samuels, S. J., Hammond, S. K., & Schenker, M. B. (1995). A cross-sectional study of musculoskeletal symptoms and risk factors in semiconductor workers. *American Journal of Industrial Medicine* 1995, 28(6), 861-871.
21. Anna Ozguler, Annette Leclerc, Marie-France Landre, Françoise Pietri-Taleb, Isabelle Niedhammer. Individual and occupational determinants of low back pain according to various definitions of low back pain. *Journal of Epidemiology Community Health* 2000; 54:215–220.
22. Riihimaki H. “Low-back pain, its origin and risk indicators”. *Scandinavian Journal of Work Environmental and Health*. 1991 ;17(2):81-90.
23. MundtD, Kelsey JL, Golden AL, Pastides H, Berg AT, Sklar J, Hosea T, Panjabi MM. An epidemiologic study of nonoccupational lifting as a risk factor for herniated lumbar intervertebral disc. *Spine*. 1993;18:595-602.
24. Michael Calnan. *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*. National Research Council and the Institute of Medicine (2001). *International Journal of Epidemiology*, Volume 31, Issue 3, 1 June 2002.
25. Mehdi Ghasemkhani, Elham Mahmudi & Hossain Jabbari. Musculoskeletal Symptoms In Workers. *International Journal of Occupational Safety and Ergonomics (JOSE)* 2008, Vol. 14, No. 4, 455–462.
26. Kilborn A. Repetitive work of the upper extremity. Part II: The scientific basis (knowledge base) for the guide. *International Journal Of Industrial Ergonomics*. 1994; 14:59-86
27. Hagberg M, Morgenstern H, Kelsh M. Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome: a review. *Scandinavian Journal of Work Environmental and Health*. Vol 18. 1992.
28. Catharine Paddock. *Prolonged Standing - Workers Health & Safety*, 2015.
29. Guidelines on work in standing/sitting positions - *Workplace Safety and health*.

How to cite this article: Desai M, Vinekar T. Prevalence of musculoskeletal problems in plastic industry workers. *Int J Health Sci Res*. 2019; 9(8):196-204.

\*\*\*\*\*