EXCELLENT PUBLISHERS

International Journal of Current Research and Academic Review

ISSN: 2347-3215 Volume 4 Number 3 (March-2016) pp. 16-24

Journal home page: http://www.ijcrar.com

doi: http://dx.doi.org/10.20546/ijcrar.2016.403.002

Prevalence of Musculoskeletal Disorder among the Manual Material Handling Workers of Central Market Area Kolkata, India

Krishnendu Sarkar[1], Samrat Dev[1], Tamal Das[2] and Somnath Gangopadhyay[1]*

[1]Occupational Ergonomics Laboratory, Department of Physiology, University of Calcutta, 92, A.P.C. Road, Kolkata – 700 009, India

[2]Department of Physiology, Vidyasagar Evening College, 39, Sankar Ghosh Lane, Kolkata – 700 006, India

Corresponding author

KEYWORDS

Posture Analysis, Nordic Questionnaire, SF12 Questionnaire, Multiple regression, Informal Sector.

A B S T R A C T

Work related musculoskeletal disorders (MSDs) are a cause of concern because of the ill health effects and high economic impact on businesses. Manual Material Handling (MMH) jobs are common in informal sector of developing countries. The present study was carried on the workers of a central market area in Kolkata to find out the prevalence of the MSD. 210 male MMH workers were randomly selected. Standardized Nordic Musculoskeletal questionnaire was used to assess the prevalence of MSD. Working posture was analyzed by Ovako working posture analysis system (OWAS). SF12 questionnaire was used to assess the physical and mental health status. Lower back was found to be worst affected body part (68 %) followed by Knee (63%), Neck (56%) and Shoulder (41%). The Physical composite score (PCS) and Mental composite score (MCS) were found to be 39.7 ± 9.11 and 46.0 ± 9.17 respectively. PCS, MCS and Frequency of lifting were found to be significant predictors of pain intensity rating. The regression model was able to predict 22.7% of the variability in the scores of the pain intensity rating. It was concluded awkward postures along with the heavy load lead to the development of musculoskeletal disorders.

Introduction

Musculoskeletal Disorders (MSD) are injuries or disorders of the muscles, tendons or nerves not directly resulting from an acute injury. These disorders are considered to be work-related when the work environment and the performance at work contribute significantly to the causation. (WHO, 1985) Work related MSDs are a cause of concern because of the ill health effects and high economic impact on businesses. In the US it was found that the mean cost per back pain case was US$6807 and this cost has remained stable since the 1960s. MSDs are also the most common

work-related health problem in Europe, Across the European Union(EU), 25% of workers complain of backache and 23% report muscular pains. MSDs are also the largest cause of absenteeism in the Member States of the EU. (Schneider and Irastorza, 2010)

Low back pain was found to be strongly associated with lifting/forceful movement, awkward posture, heavy physical work and whole body vibration, while Strong association of neck pain was found with lifting, posture and repetition. (Bernard, 1997) Gangopadhyay *et al*. (2003) reported association of repetitiveness of work, prolonged work activity and static posture with the occurrence of MSD.

The informal sector of developing countries use very little mechanical aids and therefore Manual Material Handling (MMH) jobs are common. MMH is associated with severe injuries, pain, suffering, disability, fatalities, as well as loss in efficiency and production for workers and their families, with concomitant societal economic losses. There is clear evidence in the literature that there is a high risk of these adverse outcomes with a high physical workload, especially heavy lifting. (Andersson, 1997; Burdorf and Sorock, 1997; Gordon and Weinstein, 1998; Hoogendoorn *et al*., 1999; Marras, 2005; Myers *et al*., 1999, 2002; NRC/IOM, 2001; Koplan, 1996) MMH and awkward working posture are one of the many risk factors that can be associated with the development of MSD. MMH is also the most frequent and expensive cause of compensable workplace injuries loss. (Ciriello *et al*., 2008)

According to the reports of Sen and Nag (1975) more than 70% of the total population of India are engaged directly in MMH.

The present study was carried out on the workers of a central market area in Kolkata. These workers perform MMH jobs. The objective of the present study was to find out the prevalence of the musculoskeletal disorder among the manual material handling workers of this central market.

Materials and Methods

Selections of Subjects

The present study was carried out in a central market area of Kolkata, India. 210 male manual material handling workers from this market were randomly selected for the purpose of the current study. These workers regularly perform manual material handling (MMH) job in this market area. Workers who had less than five years of experience were excluded from this study. Workers were paid lost time compensation for these study activities. Informed consent was obtained from each worker. Ethical approval for this study was provided by Human Research Ethics Committee of University of Calcutta.

Study of the Physical Parameters

The height and weight of all the subjects were measured using an anthropometer and a weighing machine. The Body Mass Index (BMI) and Body Surface Area (BSA) of the subjects were calculated using the standard formulae. (Cole *et al*., 2000; Poskitt, 2000; Banerjee and Sen, 1955)

Prevalence of Musculoskeletal Disorder

Standardized Nordic Musculoskeletal questionnaire was used to assess the prevalence of musculoskeletal disorder among the MMH workers. (Kuorinka *et al.*, 1987) Few questions were included with this questionnaire to suite the context of the

present study population. The questionnaire included general information about the workers; their work related information; information about history of accidents, discomfort feeling, body parts affected; information about MSD and absenteeism. The workers rated the intensity of pain in a scale of 0-10 (0 implying no pain and 10 implying maximum pain)

Analysis of Working Posture

The jobs of the workers were videotaped. The working posture of the workers was analyzed by Ovako working posture analysis system (OWAS). (Karhu *et al*., 1977) OWAS identifies the most common work postures for the back (4 postures), arms (3 postures) and legs (7 postures), and the weight of the load handled (3 categories). It recommends whether the posture is correct or there is any need of any corrective measures.

Assessment of Physical and Mental Health

One of the popular and standard health outcome measuring questionnaires is the 36 item short form health survey (SF36). The analysis of this SF36 questionnaire gives two summary scores, Physical Composite Score (PCS) and the Mental Composite Score (MCS), which denotes the physical health status and the mental health status respectively. (Ware *et al*., 2001) Short form Health Questionnaire (SF12) is a subset of this SF36 questionnaire which can produce the PCS and MCS without substantial loss of information (Ware *et al.,* 1998). This SF12 questionnaire was used to assess the physical and mental health status of the workers.

Statistical Analysis

The data were analyzed using the SPSS statistics package (version 20.0). Descriptive statistics such as mean and standard deviation was computed for different physical characteristics (age, Height, weight etc.,) Stepwise multiple regression analysis was performed to examine the association between pain intensity with years of experience, BMI, BSA, PCS, MCS and average frequency of lifting.

Results and Discussion

The workers in this market area perform manual handling job repeatedly. They have to carry large baskets over their head. Vegetables are packed into these baskets. The baskets weigh from 100 kg to 500 kg. The smaller (100 kg) basket is carried by one worker while the heavier baskets are carried by three to five workers collectively. These baskets are manually lifted overhead manually. 10-15 workers lift this basket over the head of the fellow workers. The lifting process is plagued by frequent bending and twisting of the trunk and adoption of awkward postures.

The physical characteristic (age, height, weight, BMI, BSA) of the study sample is shown in table 1. The mean age was found to be 36.3 ± 6.64 years; the mean work experience was found to be 18.1 ± 9.01 years. This signifies that these workers begin their job at early age. The mean BMI was found to be in the normal range. (WHO, 2004)

The analysis of questionnaires revealed that all the workers are extremely physically exhausted due to their strenuous lifting tasks. This not only contributes to severe pain and discomfort feeling but also onset of mental stress to a great extent. The Nordic Musculoskeletal disorder questionnaire revealed the last four week prevalence of Musculoskeletal disorders among the workers. Figure 1 represents the

percentage of respondent having discomfort feeling at different body parts. Lower back was found to be worst affected body part with 68 % of the worker having discomfort feeling in that region. Lower back was followed by Knee (63%), Neck (56%) and Shoulder (41%). Similar results are also found in various other studies involving manual material handling. (Aghilinejad *et al*., 2012; Gangopadhyay *et al*., 2003; Gangopadhyay *et al*., 2006; Gupta and Ram, 1987)

The results of SF-12 questionnaire are an absolute reflection of the alarming situation of the workers in the central market area. The PCS and MCS of the workers were found to be 39.7 ± 9.11 and 46.0 ± 9.17 respectively. A zero score represents the lowest level of health and a score of 100 indicates the highest possible health status. A mean score of 50 with a standard deviation of 10 is considered to be normal. (Ware *et al*., 1998) The analysis of SF-12 questionnaire clearly reveals that most of the porters are suffering from some grave physical and mental health problems. The probable causal factors can be summarized as follows. Since most of them are migrant labor, so staying away from family, may lead to feeling of loneliness. Moreover their limited income after a tiring day of work is not sufficient to meet the demands of the family, also enhance their anxiety level. The inability to support their family adequately even after performing such hazardous tasks makes them feel low.

The work characteristics are shown in table 2. The high prevalence of the MSD can be attributed to the fact that they have to carry heavy load overhead. They perform this activity on an average 34 times daily. Datta *et al.* (1975) from their studies on eastern Indian male worker concluded that the maximum permissible load that can be carried over head is not more than 30 Kgs. The average load carried by these workers is more than 100 Kgs.

The posture analysis results are shown in Table 3. The postures mostly adopted while handling heavy loads involve squatting, stooping, standing, walking and unloading. There were also frequent twisting and bending of the body with many jerk movements. All the postures required corrective measures as soon as possible or immediately. The high prevalence of MSD may be attributed to the adoption of awkward postures with repeated twisting, bending and jerking. Lifting heavy load in awkward posture has been shown to be associated with occurrence of MSD. (Garg, 1989) Awkward postures like lateral twist and bending have been found to be significantly associated with lower back pain. (Punnett *et al.*, 1991) The muscle loading and compressive forces on inter vertebral disc is affected by the posture, location and weight of a load. (Mecgil, 1985) Therefore the musculoskeletal problems of these workers appear to be associated with these awkward postures; carrying and lifting of heavy loads.

The workers rated their pain intensity in a scale of 0-10. The mean pain intensity of all the body parts was found to be 6.6 ± 2.36. Stepwise multiple regression analysis was performed and the results are presented in table 4. The pain intensity was entered in the regression model as dependent variable. Years of experience, BMI, BSA, PCS, MCS and frequency of lifting were entered as predictors. The regression analysis showed that PCS, MCS and frequency of lifting were significant predictors of pain intensity. With the increase in PCS and MCS the pain intensity rating decreases.

Table.1 Demographic Data of the Study Population

	Mean	Standard Deviation	Maximum	Minimum
Age (year)	36.3	8.64	62.0	22.0
Height (cm)	164.2	6.24	180.5	149.0
Weight (Kg)	62.6	8.99	94.0	35.0
BMI ($Kg.m^{-2}$)	23.2	3.25	35.1	13.7
BSA (m^2)	1.74	0.131	1.34	2.11
No. of school year	1.9	2.87	12.0	0.0
Experience (years)	18.1	9.01	45.0	5.0

Table.2 Work Description of the Study Population

	Mean	Standard Deviation	Maximum	Minimum
Hours worked per day	10.01	2.515	16	3
wage per day (Rs.)	259.05	81.194	500	100
No. of breaks obtained on each working day	2.8	1.31	6	0
Length of breaks obtained on each working day (minutes)	45.5	26.97	90	0
Average frequency of lifting in a day (times/day)	33.8	9.89	60	9
Average amount of loads lifted and carried each time alone (kg)	114.9	12.64	150	80
Average distance travelled per load (m)	103.3	44.70	200	50

Figure.1 Discomfort Feeling in Different Body Parts

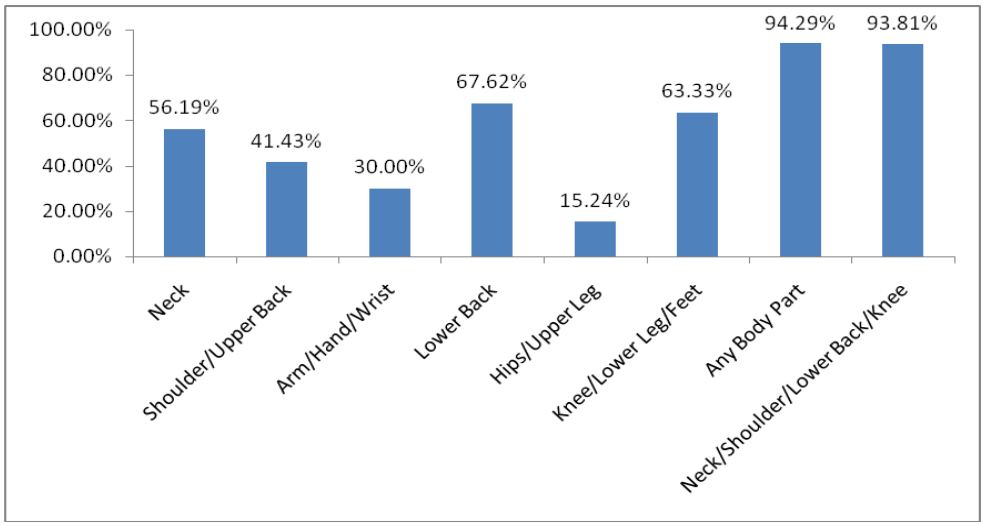


Table.3 Analysis of Working Posture using OWAS Method

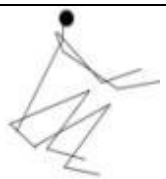
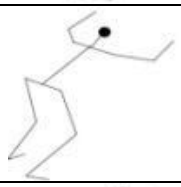
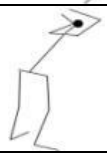
Activity	Stick Diagram	OWAS code	Action Category	Remarks
Lifting		2143	3	Corrective measures as soon as possible
Lifting		2343	4	Corrective measures immediately
Lifting		2143	3	Corrective measures as soon as possible
Lifting		2243	4	Corrective measures immediately
Carrying		1343	3	Corrective measures as soon as possible
Carrying		1343	3	Corrective measures as soon as possible
Unloading		2343	4	Corrective measures immediately

Table.4 Stepwise Multiple Regression Analysis

Model		β Coefficients		p Value	R^2
		Unstandardized	Standardized		
1	(Constant)	.000		<0.05	0.183
	PCS	.000	-.428	<0.05	
2	(Constant)	.000		<0.05	0.202
	PCS	.000	-.457	<0.05	
	Frequency of Lifting per day	.028	.141	0.03	
3	(Constant)	.000		<0.05	0.227
	PCS	.000	-.429	<0.05	
	Frequency of Lifting per day	.008	.169	0.01	
	MCS	.011	-.163	0.01	
Dependent Variable: Pain Scale data					

The increase in both the PCS and MCS signifies an improved physical and mental health status. An increased frequency of lifting was positively correlated with increased pain intensity ratings. The regression model was able to predict 22.7% of the variability in the scores of the pain intensity rating.

It is recommended that the weight of the load should be reduced to improve the condition of the workers. Mechanical aid for lifting the load may be introduced to diminish the ill effects of lifting hazards.

Conclusion

It can be concluded from this study that the workers of the central market area have high prevalence of MSDs, Awkward postures along with the heavy load lead to the development of musculoskeletal disorders.

Acknowledgement

The authors express their sincere gratitude to the Indian Council of Medical Research, New Delhi for their financial assistance in the pursuance of this study.

References

Aghilinejad, M., Javad Mousavi, S.A., Nouri, M.K., Ahmadi, A.B. 2012. Work-related musculoskeletal complaints among workers of Iranian aluminum industries. *Arch. Environ. Occup. Health*, 67: 98–102.

Andersson, G.B. 1997. The epidemiology of spinal disorders. In The Adult Spine: Principles and Practice, J.W. Frymoyer, ed. (Philadelphia: Lippincott-Raven Publisher), pp. 93–141.

Banerjee, S., Sen, R. 1955. Determination of the surface area of the body of Indians. *J. Appl. Physiol.,* 7: 585–588.

Bernard, B.P. 1997. Musculoskeletal Disorders and Workplace Factors (97-141): A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back (National Institute of

Occupational Safety and Health).

Burdorf, A., Sorock, G. 1997. Positive and negative evidence of risk factors for back disorders. *Scand J. Work Environ. Health*, 23: 243–256.

Ciriello, V.M., Dempsey, P.G., Maikala, R.V., O'Brien, N.V. 2008. Secular changes in psychophysically determined maximum acceptable weights and forces over 20 years for male industrial workers. *Ergonomics,* 51(5): 593–601.

Cole, T.J., Bellizzi, M.C., Flegal, K.M., Dietz, W.H. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*, 320: 1240–1243.

Datta, S.R., Chatterjee, B.B., Roy, B.N. 1975. Maximum permissible weight to be carried on the head by a male worker from eastern India. *J. Appl. Physiol.*, 38: 132–135.

Gangopadhyay, S., Das, T., Ghoshal, G., Ghosh, T. 2006. Work organization in sand core manufacturing for health and productivity. *Int. J. Industrial Ergonomics*, 36: 915–920.

Gangopadhyay, S., Ray, A., Das, A., Das, T., Ghoshal, G., Banerjee, P., Bagchi, S. 2003. A study on upper extremity cumulative trauma disorder in different unorganised sectors of West Bengal, India. *J. Occup. Health*, 45: 351–357.

Garg, A. 1989. Epidemiological Basis for Manual Lifting Guidelines. Cincinnati, OH: Department of Health and Human Services (National Institute for Occupational Safety and Health). *NIOSH Report*, #937384.

Gordon, S.L., Weinstein, J.N. 1998. A review of basic science issues in low back pain. *Phys. Med. Rehabil. Clin. N. Am.*, 9: 323–342.

Gupta, B., Ram, N. 1987. Occupational backache in railway porters. *Ind. J. Occupational Health*, 30.

Hoogendoorn, W.E., Van Poppel, M.N., Bongers, P.M., Koes, B.W., Bouter, L.M. 1999. Physical load during work and leisure time as risk factors for back pain. Scand J. Work Environ. Health, 25: 387–403.

Karhu, O., Kansi, P., Kuorinka, I. 1977. Correcting working postures in industry: A practical method for analysis. *Appl. Ergonomics*, 8: 199–201.

Koplan, J.P. 1996. Hazards of cottage and small industries in developing countries. *Am. J. Ind. Med.*, 30: 123–124.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., Jørgensen, K. 1987. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl. Ergonomics*, 18: 233–237.

Marras, W.S. 2005. The future of research in understanding and controlling work-related low back disorders. *Ergonomics*, 48: 464–477.

Mcgill, S.M., Norman, R.W. 1985. Dynamically and statistically determined low back moments during lifting. *J. Biomech.*, 18: 877–888.

Myers, A.H., Baker, S.P., Li, G., Smith, G.S., Wiker, S., Liang, K.Y., Johnson, J.V. 1999. Back injury in municipal workers: a case-control study. *Am. J. Public Health*, 89: 1036–1041.

Myers, D., Silverstein, B., Nelson, N.A. 2002. Predictors of shoulder and back injuries in nursing home workers: a prospective study. *Am. J. Ind. Med.*, 41: 466–476.

NRC/IOM (National Research Council, the Institute of Medicine). 2001.

Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities (Washington, D.C.: The National Academies Press).

Poskitt, E. 2000. Body mass index and child obesity: are we nearing a definition? *Acta Pædiatrica*, 89: 507–509.

Punnett, L., Fine, L.J., Keyserling W.M., Herrin, G.D., Chaffin, D.B. 1991. Back disorders and non-neutral trunk postures of automobile assembly workers. *Scand J. Work Environ. Health*, 17: 337–346.

Schneider, E., Irastorza, X. 2010. Work-related musculoskeletal disorders in the EU. European Agency for Safety and Health at Work, Luxembourg: Publications Office of the European Union.

Sen, R.N., Nag, P.K. 1975. Work organization of heavy load handling in India. *J. Hum. Ergol., (Tokyo).* 4: 103–113.

Ware, J.E., Kosinski, M. 2001. SF-36 Physical & mental health summary scales: a manual for users of version 1. Quality Metric Inc.

Ware, J.E., Kosinski, M., Keller, S.D. 1998. SF-12: How to score the SF-12 physical and mental health summary scales. Health Institute, New England Medical Center.

WHO. 1985. Identification and Control of Work-Related Diseases (Geneva, Switzerland: World health Organisation).

WHO. 2004. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet, (London, England),* 363(9403): 157.

How to cite this article:

Krishnendu Sarkar, Samrat Dev, Tamal Das and Somnath Gangopadhyay. 2016. Prevalence of Musculoskeletal Disorder among the Manual Material Handling Workers of Central Market Area Kolkata, India. *Int.J.Curr.Res.Aca.Rev.*4(3): 16-24.
doi: http://dx.doi.org/10.20546/ijcrar.2016.403.002