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Prevalence of musculoskeletal disorders among sugar factory Workers of loni: an ergonomic study

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Abstract:
Background: *Musculoskeletal disorders are the most common self-reported work related illness. Manual job in sugar factory involves the separating the sugarcane leaves before it is crushed into the crush rollers, checking the texture of juice extracted, crystallized sugar, comparing the colour crystallized sugar from raw sugar, adjusting packages into machine for packing, loading the packed sugar into trucks to store them into warehouse increasing the risk of musculoskeletal disorders.*
Method: *This observational at Pravara Sugar Factory Ltd. Loni. Total 4 jobs requiring manual workers and 50 workers performing the tasks were observed using Rapid Entire Body Assessment.*
Result: *Results observed from REBA method indicate that 50% tasks performed by the workers were in 4th level (very high risk), 18.75% of tasks were in 3rd (high risk), 25% tasks were in 2nd level (medium risk) and 6.25% tasks were in level 1 (low risk) of final scores categories by REBA method.*
Conclusion: *Tasks performed at sugar factory possess high risk and all other tasks possess some degree of risks for occurrence of musculoskeletal injury amongst workers requiring immediate measures including ergonomic intervention. An informative lectures about ergonomics and mechanization of tasks wherever possible would be helpful.*
Keywords: *WMSDs, REBA, Sugar factory workers, ergonomics, Physiotherapy, Industrial Therapy,*

I. Introduction

In a year, approximately 10 lac people take time away from work because of repetitive motion or overexertion to recover from musculoskeletal pain or functional loss[1]. Occupational disease covers pathological conditions induced by prolonged work, exertion harmful factors inherent in materials, equipments or working environment. There are diseases which are caused by etiological factors inherent in circumstances in which workers work. Bad posture, repeated physical effort or psychological stresses are contributing factor for occupational diseases[2]. Long work hours and strenuous activities put workers at risk for work-related musculo-skeletal disorders (WMSDs), predominantly low back pain (LBP). WMSDs are a major health problem among workers in both industrially developed and developing countries[3]. Musculoskeletal disorders (MSDs) are currently one of the most crucial problems faced by the ergonomists in the workplace. In industrially developing countries, the problems related to workplace injuries are extremely serious. Poor working conditions and the absence of an effective work injury prevention program in industrially developing countries have resulted in a very incidence of MSDs[4]. Musculoskeletal disorders are the most common self-reported work related illness. They are manifestation of ergonomic hazards and are the leading cause of disability of people during the working years. Work related musculoskeletal disorders are responsible for lost earnings, workers compensation payments and medical payments, and are costly than any other single health disorder[1].

Sugar factory and refineries produce raw sugar from the sugar canes. Raw sugar which is sugar that still contains molasses is processed into white refined sugar which is normally consumed in households and used as an ingredient in soft drinks and foods[5]. There are total 173 co-operative sugar factories and 23 private sugar factories in Maharashtra[6]. Sugar factory processing includes preparation and processing. sugar cane is crusher rollers break the cane and extract a large part of juice. Juice is purified by the process of clarification and evaporation. Crystallization is the next step in manufacture of sugar. Raw sugar crystals and molasses are separated by centrifuging method. Next step involves drying and packaging. Packed sugar loaded onto truck via transfer belts and is stored in warehouse[7].
[Fig1. Loading and adjusting the bags in the truck.]

Manual job in sugar factory involves the separating the sugarcane leaves before it is crushed into the crush rollers, checking the texture of juice extracted, crystallized sugar, comparing the colour crystallized sugar from raw sugar, adjusting packages into machine for packing, loading the packed sugar into trucks to store them into warehouse.

[Fig2. Workers adjusting bag for packing.]

The workers are exposed to large quantities of liquid, fumes and gases may be given off at various stages of the refining process (carbon dioxide, sulphur-dioxide, carbon monoxide, hydrochloric acid fumes). The fumes and steam given off cause troubles and are sometimes toxic. Dust with residue from the ovens can irritate the respiratory tract and Baggessosis has been reported in the past[8].

[Fig3. Shifting the bags for further loading into trucks

In some parts of the factory (as near turbines), noise levels may exceed tolerable limits. Decomposing organic matter gives off unpleasant odours (suppurated hydrogen). The commonest injuries occurring at worksite are heatstroke, various kinds of dermatitis, conjunctivitis, deafness, falls and burns. The incidences of dental decay are fairly high. In general there are higher chances of morbidity. Tuberculosis, chronic fatigue is distinctive in tropical countries and these are diseases which are peculiar to the area[8].

The 'ergonomics' was coined from Greek words ergon (meaning "work") and nomos (meaning "rules"); hence, the literal definition of ergonomics is the "rules of work." Ergonomics provides a set of conceptual guideposts for adapting workplaces, products, and services to fit human needs. The field provides a strategy for engineering design and philosophy for good management, all with the underlying goal of improving the fit between humans and our activities. Some people have even described ergonomics as a way of thinking[9].

The Rapid Entire Body Assessment (REBA) method was developed by Dr. Sue Hignett and Dr. Lynn McAtamney , ergonomists from University of Nottingham in England (Dr. McAtamney is now at Telstra, Australia). REBA is a method that targets on posture to estimate the risks of work related entire body disorder A REBA assessment gives a quick and systematic assessment of the body postural risks to a worker. The analysis can be conducted before and after an intervention to demonstrate whether the intervention has worked to lower the risk of injury or not[10]. The REBA was designed for easy use without need for an advanced degree in ergonomics or expensive equipment. You only need the worksheet and a pen. Using the REBA worksheet, the evaluator assigns a score for each of the following body regions: wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees. After the data for each region is collected and scored, tables on the form are then used to compile the risk factor variables, generating a single score that represents the level of MSD risk:

[Table 1. risks of MSD depending on REBA score.]

Since the time of introduction of REBA, studies showed their value for postural assessments of jobs in several occupational settings, including construction[11,12], supermarket workers[13], clothing manufacturing[14] , assembly[15], fire-fighters and emergency medical technicians[16], sawmill[17] and hospital[18]. The present study aimed to detect ergonomic risk assessment by observational method, REBA, in terms of postural loading scores based on analysis of working postures taken from sugar factory.

II. Method

This cross sectional study was conducted in order to investigate risk assessment results of REBA in sugar factory. Study was conducted at Padmashree Vitthalrao Vikhe Patil Sugar Factory Ltd. Loni. Total four job categories which required the manual work were studied.Four job categories were derived by assessing the job requirement at the factory where manual work was needed. Four categories were 1) detrashing the sugarcane before crushing which included bending forward, lifting trash, straightening and throwing it in bin. 2) Packing sugar into the bag was a sitting job which included lifting bags, adjusting it below the machine, sliding the bag onto the ramp and then manually sewing the bag. 3) Shifting bags from ramp to the truck required workers bending forward, lifting bag onto the back, shifting it from ramp to the truck, unloading it and lastly adjusting it. 4) Storing of bags from truck to storehouse was done by performing unloading the bags, shifting it in on the ramp and adjusting the bags in storehouse.All the available workers (no. 50) were observed during study. Permission to perform the study was conducted from college and company as well.All observations were performed by trained physiotherapist. Job information was collected to ensure the completion of ergonomic risk assessment tool using REBA. The observations according to REBA tool were analysed for all four groups and analysis is performed.

REBA tool can be used for rapid assessment of entire bodies by evaluating musculoskeletal loads due to posture, repetitions and force. In REBA the body is divided into 2 groups A and B. The group A consists of neck, legs and trunk and group B consisted of lower arms, upper arms and wrist[19]. Group A has a total of 60 posture combinations for the trunk, neck and legs. This reduces to nine possible scores to which a 'Load/Force' score is added. Group B has a total of 36 posture combinations for the upper arms, lower arms and wrists, reducing to nine possible scores to which a 'Coupling' score is added. The A and B scores are combined in Table C to give a total of 144 possible combinations and finally an activity score is added to give the final REBA score[20].

III. Result

In this study total 50 workers of Pravara sugar factory were analyzed. Results observed from REBA method indicate that 50% tasks performed by the workers were in 4th level (very high risk), 18.75% of tasks were in 3rd (high risk), 25% tasks were in 2nd level (medium risk) and 6.25% tasks were in level 1 (low risk) of final scores categories by REBA method. Table2 shows result of REBA assessment and prioritization of risk level. Based on the results the workers performing tasks such as throwing of trash while detrashing the sugarcane before crushing it into the crushers, lifting the sugar bags on to the back, shifting them and unloading them as well as adjusting the bags while shifting from factory area to the storehouse have potential of leading to musculoskeletal disorders.

[Table 2: Result of REBA assessment and prioritization of risk level.]

IV. Discussion

Musculoskeletal disorders (MSDs) are a common health problem and a major cause of disability throughout the world. The economic loss due to such disorders affects not only the individual level but also the organization level and the society as a whole[21]. A study on posture stress on fire-fighters and emergency medical technicians associated with repetitive reaching, bending, lifting and pulling tasks used various ergonomic tools of which REBA was the one. High to very high risks were found in various tasks required to be performed by firefighters[16]. Many studies revealed that REBA is a useful tool to assess the manual handling hazards. It may be more useful to assess before and after implementing the change[13]. Another study showed that in 99.1% of the sugar factory workers, the level exposure to MSD risks was high and very high. Awkward postures, manual material handling and long hours of standing were contributing factors for the work related musculoskeletal disorder[22].The purpose of the study was to assess the ergonomic risk for working postures in sugar factory. In the current study, the results of ergonomic risk assessment showed that 50% tasks performed by the workers were of high risk requiring immediate intervention. These tasks required continuous bending, twisting of back, as repetition of terminal movements of neck back and upper limb as well as lifting heavy weights on back repeatedly.

Ergonomic interventions to reduce musculoskeletal disorders include engineering improvements as well as administrative improvements. Engineering improvements include rearranging, modifying, redesigning, providing or replacing tolls, equipments, workstations, packaging, parts process, products or materials. Like while shifting the heavy bag worker can use the devise as shown in figure one to avoid straining of back.

Areas where mechanization is not possible, ergonomically correct measures to avoid musculoskeletal disorders are to be taken. As in while lifting the heavy bags person can kneel down carefully and position object to be lifted close to knee on ground then grasping object firmly with both hands and sliding object up to mid-thigh. Shifting objects onto knee of other leg.

Administrative improvements by alternating heavy tasks with light tasks, providing variety in jobs to eliminate or reduce repetition, adjusting work schedules, work pace or work practices, providing recovery time, rotating workers through jobs that use different muscles body parts or postures can be done.

V. Conclusion

From this study we concluded that 50% tasks performed at sugar factory possess high risk and all other tasks possess some degree of risks for occurrence of musculoskeletal injury amongst workers requiring immediate measures including ergonomic intervention. In rural areas this issue is neglected due to lack of resources. An informative lecture about ergonomics and mechanization of tasks wherever possible would be of help.

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References

[1]. Amick BC, Robertson MM, DeRango K, et al. Effect of Office Ergonomics Intervention on Reducing Musculoskeletal Symptoms. SPINE Volume 28, Number 24, pp 2706–2711.
[2]. Gangopadhyay BP. A study on prevalence of upper extremity repetitive strains among the handloom wavers of west Bengal. J human ergol 32: 17-22, 2003
[3]. Durlov S, Chakrabarty S, Chatterjee A, et al. Prevalence of low back pain among handloom weavers in West Bengal, India. International Journal of Occupational and Environmental Health 2014 VOL. 20 NO. 4. 333-339
[4]. Choobineh, M. Hosseini, M. Lahmi, R. Khani, et al. Musculoskeletal problems in Iranian hand-woven carpet industry: Guidelines for workstation design," Applied Ergonomics, vol. 38, 2007, pp. 617-624.
[5]. Sugar refinery (Authority Control, NDL: 00570455). Available from https://en.wikipedia.org/wiki/Sugar_refinery
[6]. Maharashtra State Co-operative Sugar Factories Federation Ltd. 2010. Available from: http://mahasugarfed.org/
[7]. Sugar-How products are made. Advameginc. Available from: http://www.madehow.com/Volume-1/Sugar.html

[8]. Prasad A. Complete information on sugar industry. Available from: http://www.preservearticles.com/2012030625157/complete-information-on-sugar-industry.html
[9]. Macleod D.The Ergonomics Edge: Improving Safety, Quality, and Productivity. Canada: John Wiley and sons, Inc; 1995.
[10]. REBA worksheet. CUErgo- Cornell university ergonomic web. Available from: http://ergo.human.cornell.edu/ahReba.html
[11]. Kim S, Nussbaum MA, Jia B. Low back injury risks during construction with prefabricated (panelised) walls: effects of task and design factors. Ergonomics. 2011;54:60-71.
[12]. Rwamamara RA. Risk assessment and analysis of workload in an industrialized construction process. Construction Information Quarterly. 2007;9(2):80-85. Coyle A. Comparison of the rapid entire body assessment and the New Zealand manual handling "hazard control record", for assessment of manual handling hazards in the supermarket industry. Work. 2005;24:111-116.
[13]. Erdinc O, Vayvay O. Ergonomics interventions improve quality in manufacturing: a case study. International Journal of Industrial and Systems Engineering. 2008; 3:727-745.
[14]. Kim YK, Kang DM, Koh SB, et al. Risk factors of work-related musculoskeletal symptoms among motor engine assembly plant workers. Korean J Occup Environ Med. 2004; 16(4):488-498.
[15]. Gentzler M, Stader S. Posture stress on fire-fighters and emergency medical technicians (EMTs) associated with repetitive reaching, bending, lifting, and pulling tasks. Work. 2010;37(3):227-239.
[16]. Jones T, Kumar S. Comparison of ergonomic risk assessments in a repetitive high-risk sawmill occupation: Saw-filer. Int J Ind Ergon. 2007;37(9-10):744-753.
[17]. Janowitz I, Gillen M, Ryan G, et al. Measuring the physical demands of work in hospital settings: Design and implementation of an ergonomics assessment. Appl Ergon. 2006; 37(5):641-658.
[18]. Kazemi S, Savas S, Aydos L. Evaluation of Ergonomic Postures of Physical Education and Sport Science by REBA and Its Relation to Prevalence ofMusculoskeletal Disorders. IOSR-JSPE. 2016; 3(2):9-12.
[19]. Hignett S, McAtamney L. Rapid entire body assessment (REBA). Appl Ergon. 2000;31(2):201-205.
[20]. Naz H. Kwatra S. Ojha P. Prevalence of musculoskeletal disorders among handloom weavers of Uttarakhand : an ergonomic study.Journal of Applied and Natural Science 7 (1):102 – 105 (2015)
[21]. Choobineh a, Tabatabaee S. Musculoskeletal problems among workers of an Iranian sugar producing factory. JOSE 2009, 15(4):419-424.

Figures & Tables

Fig1. Loading and adjusting the bags in the truck.

Fig2. Workers adjusting bag for packing.

Fig3. Shifting the bags for further loading into trucks

Score	Level of MSD risk
1	Negligible risk, no action required
2-3	Low risk, change may be needed
4-7	Medium risk, further investigation, change soon
8-10	High risk, investigate and implement change
11+	Very high risk, implement change

Table1. Risks of MSD depending on REBA score.

Level	Final REBA score	Frequency	Percentage	Corrective measure necessity and timing
0	1	0	0%	unnecessary
1	2-3	1	6.25%	might be necessary
2	4-7	4	25%	necessary
3	8-10	3	18.75%	necessary (as soon as possible)
4	11-15	8	50%	necessary (urgent)

Table2: Result of REBA assessment and prioritization of risk level.