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Assessment of working posture among sugar factor workers

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Abstract

Background: Posture is a physical factor identified in occupational musculoskeletal injuries awkward working posture had a strong relation to the causation of musculoskeletal injuries. In sugar-producing factories, workers are directly involved in the production process. Industrial physical activities such as manual material handling (e.g., heavy load lifting, lowering, carrying, pulling, and pushing) and awkward working postures are very common. In this situation, a high rate of WMSDs is expected. Ovako working posture analysis was used for asses the working posture (OWAS).

Objectives: To assess working posture in sugar factory workers

Methodology: The observational study done on thirty participants working in pravaranagar sugar factory. Working posture was analysed by ovako working posture analysis system (OWAS)

Results: The OWAS shows some working posture needs modification and intervention the distribution of action category among trunk. The action category 1(code1) was 26.6%. The action category 2(code2) was 23.3%. The action category 3(code3) was 23.3%. The action category (code4) is 26.6%. The distribution of action category among upper extremity. The action category 1(code1) was of3.33. The action category 2(code2) was 36.6%. The action category 3(code3) is of 30%.The action category (code4) was 26.6%. The distribution of action category among lower extremity. The action category 1(code1) was of 26.6%. The action category 2(code2) was of 20%. The action category 3(code3) is of 30%.The action category (code4) was 26.6%.

Conclusion: This study shows that some postures were inappropriate while working and they need to be corrected using ergonomic intervention and work place modifications. Lectures and educations programs should be conducted in sugar producing factories.

Keywords: work related musculoskeletal disorders, ovako working posture analysis system, working posture

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, 2] Many occupational activities and work tasks are done by workers which can lead to musculoskeletal disorders partially caused by adverse work condition [3]. They can be exacerbated by work place exposures, and they can impair work capacity. It is important to remember that personal and environmental and socio cultural factors usually play a major role for risk factor of the diseases [4]. WMSDs include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels. These include clinical syndromes such as tendon inflammations and related conditions such as tenosynovitis, epicondylitis, bursitis, nerve compression disorders, carpal tunnel syndrome, sciatica, and osteoarthrosis, as well as less well standardized conditions such as myalgia, low back pain and other regional pain syndromes not attributable to known pathology. Body regions most commonly involved are the low back, neck, shoulder, forearm, and hand, although recently the lower extremity has received more attention.[6] WMSDs are widespread in many countries, with substantial costs and impact on quality of life. Although not uniquely caused by work, they constitute a major proportion of all registered and or compensable work-related diseases in many countries. Accurate data on the incidence and prevalence of musculoskeletal disorders are difficult to obtain and official statistics are difficult to compare across countries. WMSDs are the single largest category of work-related illness, representing a third or more of all registered occupational diseases in the United States. WMSDs occur in certain industries and occupations with rates up to three or four times higher than the overall frequency.

Awkward working posture is a physical factor identified in occupational musculoskeletal injuries. The National Institute for Occupational Safety and Health reported that awkward working posture had a strong relation to the causation of musculoskeletal injuries. In scientific literature, awkward posture is one that involves considerable deviation from neutral. Typical examples of awkward posture include reaching behind, twisting, working, overhead, wrist bending, kneeling, stooping, forward and backward bending and squatting [7] The physical demands of the work tasks require strength and endurance as well as high levels of coordination due to dynamic standing surface and this workers are exposed to many of the recognized risk factors for the development of work-related musculoskeletal disorders. These risk factors include repetitive bending and lifting, static awkward postures, high force lifting exertions, repetitive motion and exertions of the upper extremity and lower extremity levels of muscular fatigue [1, 4, 6, 8]. In many rapidly developing countries, where

labor is cheap proper occupational hygiene and posture analysis methods are often neglected. Proper sitting arrangements and work environment are seldom provided. The workers being economic migrants accept adverse conditions as a part of the job and mostly work in bad posture. The small and medium scale enterprises (SMEs) are much greater in number in Indian economy and these are the places where work posture analysis is mostly neglected. Repetitive processes and manual material handling is the major problems in the hand tool manufacturing. Therefore, musculoskeletal disorders (WMSDs) are related to such high repetitive processes and working in bad posture. Thus, to improve the efficiency of the workers their posture needed to be assessed and corrective measures should be adopted to avoid the musculoskeletal disorders [8].

The Indian sugar industry is a key driver of rural development, supporting India's economic growth. The industry is inherently inclusive supporting over 50 million farmers and their families, along with workers and entrepreneurs of almost 500 mills, apart from a host of wholesalers and distributors spread across the country. In Maharashtra the sugarcane industry is quite evenly and widely spread, it has higher concentration in Sangli, Kolhapur, Satara, Pune, Solapur and Ahmednagar district.

In sugar-producing factories, workers are directly involved in the production process. In this industry physical activities such as manual material handling (e.g., heavy load lifting, lowering, carrying, pulling, and pushing) and awkward working postures are very common. In this situation, a high rate of WMSDs is expected. The sugar plant studied has used old technology to produce sugar for over 50 years. The production process is very labor intensive and workers are exposed to WMSD risk factors. According to the workers' medical records is around 22.75% of all occupational illnesses were related to the musculoskeletal system. As far very less ergonomic interventional studies were been conducted in the sugar producing industry to determine the prevalence of WMSDs and to assess physical exposure to work-related musculoskeletal risks [9, 10].

It is widely spread, in rural areas at the sugar industrial workplace a variety of factors influence the level of risk for the working population of sugar industry. They include the extent of exposure to hazards, which in turn is affected by process design, the safety precautions taken the extent and quality of support services and their ability to respond rapidly and effectively to injury or disease. The extent to which workers and management a like understand the industrial process the control technologies and safety equipment is also important. The working and living conditions of the sugar industry workers are extremely poor. The occupational health problems in workers working in various processing units of sugar industry are enormous mainly because of variety of occupational stress factors. The little attention have been paid on occupational stresses in sugar industry workers [8, 9].

Sugar factory and refineries produce raw sugar from the sugar canes. Raw sugar is the sugar that still contains molasses which is processed into white refined sugar which is normally consumed in households and used as an ingredient in soft drinks and foods. There are total 173 co-operative sugar factories and 23 private sugar factories in Maharashtra. Sugar factory processing includes preparation and processing. Sugar cane is crushed on rollers that 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 [10].

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 color crystallized sugar from raw sugar, adjusting packages into machine for packing, loading the packed sugar into trucks to store them into warehouse. 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 that are released 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. In some parts of the factory (as near turbines), noise levels may exceed tolerable limits. Decomposing organic matter gives off unpleasant odors (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 [22, 24]. Sugar industry workers working in all the sections have to perform various types of jobs rotation of valves of machineries at various sections, baling of biogases, lifting carrying in sugar house and storage house involves movement of body in awkward posture [8, 9, 10].

Fig 1: (Loading heavy sugar bags into trucks)

The workers from storage section of sugar industry are continuously engaged for lifting and carrying the heavy bags of sugar. They have to arrange stacks of the bags in storage house and also load the trucks with bags continuously. Working hours of storage house workers are about eight hours in shift and most frequently they have to continue the lifting and carrying job for additional two hours [11]. Awkward posture are some of the important tress factors to which sugar industry worker is exposed. The physiological responses of the workers changes due to occupational stresses. It was found that the workers working without any personal protective equipment. The health of worker is important but workers are illiterate and not aware of that. The point to be noted is that in

industry decision makers and management does not accept reasonability for the occupational hazards that affects the workers. Factory management have been a least concern about it [11, 9].

Postural Analysis provides an analysis of the workers posture while working. The emphasis in his section is on minimizing unnecessary worker sections and on reducing the amount of lifting done by workers during work. The psychophysical approach estimates worker capacity to perform a given task based on perception of the difficulty of a task. Extreme postures will adversely impact energy expenditure and the strength we can bring to bear to accomplish a task

Fig 2: (Worker adjusting sitting bags in awkward working posture)

Awkward or extreme postures are less efficient than postures that keep joints near the center of their range of-motion [12].

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, 13}.

Ergonomics is concerned with making the workplace as efficient, safe and comfortable as possible. Effective application of ergonomics in work system design can achieve a balance between worker characteristics and task demands. This can enhance workers productivity, provide worker safety and physical and mental well-being and job satisfaction. Many research studies have shown positive effects of applying ergonomic principles in workplace design, machine and tool design, environment and facilities design [28].

Ovako working posture analysis system) was developed in Finland in steel industry company (OWAS) (Ovako oy, in 1973) to describe the work load in the overhauling of iron smelting ovens (Karhu1977). A portable computer system was coding and analysis of OWAS has been developed(kivi1991) OWAS identifies the most common work posture for the back (4postures) arms(3postures) and legs (7postures), and the weight of the load handled (3categaries).Whole body postures is described by these body parts with four digits code. These 252 postures have been classified to our action categories indicating needs for ergonomics changes the observations are made as snapshots and sampling has usually been with constant time intervals [14. 15, 1].

OWAS stress ranking system:

1) Normal posture – No intervention required
2) Slightly harmful- Correction action should be taken during next regular review work method
3) Distinctly harmful-Correction action should be taken as soon as possible
4) Extremely harmful –Correction action should be taken immediately

Methods

This observational study was conducted in order to investigate posture risk assessment results of OWAS in sugar factory. Study was conducted at Padmashree Vitthalrao Vikhe Patil Sugar Factory Ltd. Pravaranagar. 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 available. Ethical permissions were obtained from Institutional Ethical Committee of Dr. A. P. J. Abdul Kalam College of Physiotherapy. Permission to perform the study was conducted from college and sugar factory as well.

Procedure for assessing posture in this study we used Ovako working posture analysis system (OWAS). OWAS posture system is classified in main four postures trunk, upper extremity, lower extremity and neck posture. Trunk posture is categorized in four categories and Upper extremity posture was categorized in three categories, lower extremity posture is categorized in 7 postures, neck and head posture was categorized in five postures. According to this we have assessed the posture among sugar factory workers and with the help of coding system of OWAS

Results

Distribution of action category in trunk (coding)

The action category 1normal posture who required no intervention (code1) is 26.6%. The action category 2slightly harmful (code2) is 23.3% who required Corrective action should be taken during next regular review work method. The action category 3 distinctly harmful (code3) is 23.3% who required Corrective action should be taken as soon as possible. The action category4 extremely harmful (code4) is 26.6%who required Corrective action should be taken immediately

Distribution of action category in upper limb (coding)

The action category 1 is normal posture (code1) is of 33.3% who required no intervention. The action category 2 slightly harmful (code2) is of 36.6% who required who required Corrective action should be taken during next regular review work method. The action category 3 distinctly harmful (code3)

is of 30% corrective action should taken required as soon as. The action category 4 extremely harmful (code4) is 26.6%who required Corrective action should be taken immediately

Distribution of action category in lower limb (coding)

The action category 1 normal posture (code1) is of 26.6% who required no intervention The action category 2 slightly harmful (code2) is of 20% who required Corrective action and should be taken during next regular. The action category 3 distinctly harmful (code3) is of 30% who required Corrective action should be taken as soon as possible. The action category4extremely harmful (code4) is 26.6%who required Corrective action should be taken immediately

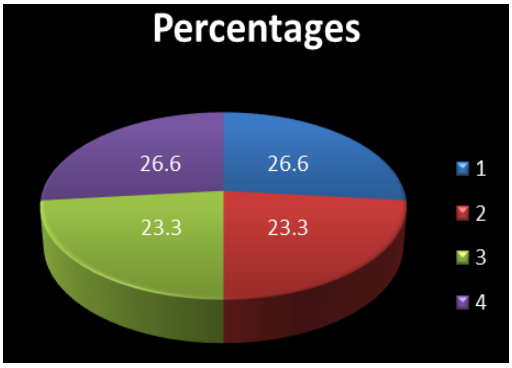

Fig 3: Distribution of action category among trunk

Result: The distribution of action category among trunk posture. The action category 1(code1) was 26.6%. The action category 2(code2) was 23.3%. The action category 3(code3) is 23.3%required. The action category (code4) was 26.6%.

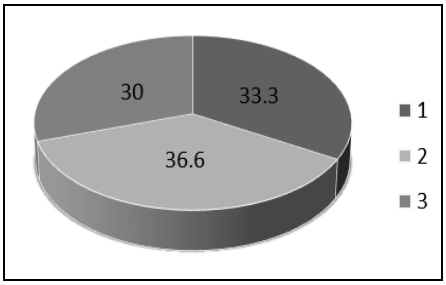

Fig 4: Distribution of action category among upper extremities

Result: The distribution of action category among upper extremity. The action category 1(code1) was of 33.3. The action category 2(code2) is of 36.6%. The action category 3(code3) was 30%. The action category (code4) was 26.6%.

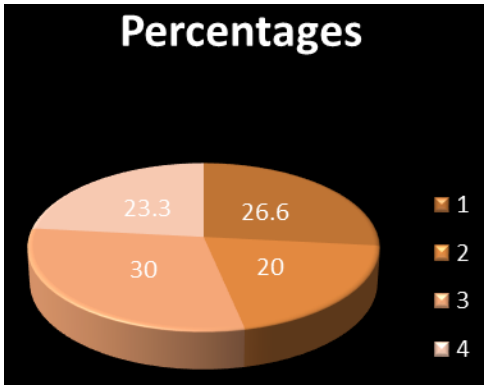

Fig 5: Distribution of action category among lower extremities

Result: The distribution of action category among lower extremity the action category 1(code1) was of 26.6% and the action category 2(code2) was 20%and the action category 3(code3) is of 30% and the action category (code4) was 26.6%.

Discussion

The some study showed that Posture analysis by owas method in 97 work station In sourak tobacco factory showed that 30.9% body postures were normal, 37.1% body postures were stressful, 26.8% body postures were harmful and 5.1% body postures were very harmful. Owas posture analysis in 20 welders of oil industry performed by Soltani in 2010 showed that 58.5% of welders were in normal posture, 34.7% were in stressful posture, 4% were in harmful posture and 2.5% were in very harmful posture. In the other similar study performed by Habibi in Mahyaman factory in Isfahan, 72.2% of the workers were in normal posture, 21.2% in stressful posture, 2.7% in harmful posture and 3.5% in very harmful postures. Comparing these results to our investigation shows that the workers of Sourak tobacco factory are at higher risk for developing musculoskeletal disorders. According to our results, ergonomic interventional programs seem to be necessary. We recommend provide and use of ergonomic chairs, frequent rests, modification in manual material handling, workers education as well as engineering controls. 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.

Conclusion

This study shows that some posture was inappropriate while working and they need to be corrected using ergonomic intervention and work place modifications. Lectures and educations programs should be conducted in sugar producing factories

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