ABSTRACT

Manual material handling of heavy loads is very frequently practiced in all spheres of life in India. It is considered to be the predominant and most economical mode in many industries belonging to both organized and unorganized sectors even in the 21st century. Truly speaking, complete elimination of manual material handling (MMH) is not possible in the near future as well. The primary reason behind this is the poor socio-economic conditions of the workers engaged in MMH. To meet their financial needs and to support their family, they are compelled to perform such rigorous tasks for years and in no way they can retract from their jobs.

There are a number of ways of load handling. It may be lifted from floor or from higher or lower level than the floor. Nevertheless most of the methods commonly adopted in manual load handling are hazardous and the workers associated with such jobs confront with a host of occupational health hazards. However the most significant of them is the occurrence of different types of injuries and accidents. Improper load handling involving awkward postures or too much heaviness of the load may contribute to the happening of the injuries and accidents. A string of adjunct factors like the work mode, work behaviour, thermal condition of the workplace, level of illumination, noise level and overall work organization seems to aggravate the situation further. Thus inculcating certain minor modifications in the mode of work can benefit a huge population of MMH workers.

In the present work an attempt was made to study ergonomics & occupational health of workers engaged in MMH, to improve the productivity, safety & health of the heavy load handling workers, i.e. an attempt MMH workers and also to try to analyze accidents which occurred during their work period. Besides another attempt was made to analyse their working environments and their relation associated with accidents.
The purpose of the study is to identify the causative factors suggest ergonomic improvement in the MMH operation for reducing considerable number of such accidents and increasing efficiency and productivity.

The aims of this study are assessment of the prevalence of injuries and accidents among the MMH workers of the unorganized as well as the organized sectors and to specify the probable causative factors that contribute greatly to the occurrence of occupational accidents in both the sectors. To identify the physiological stressors, environmental stressors associated with the occurrence of accidents. The study also aims to suggest some remedial measures and to modify the existing working procedures and thereby reducing the number of injuries and accidents and also enhance the efficiency of the work system.

The study was conducted in four unorganized sector workgroups, which includes the workers of central market area, brick kiln, railway porters and handcart pullers. Apart from that four industries belonging to the organized sector, i.e. the heavy engineering industries; the steel mills; jute mills and construction industries were included in this study. 50 male MMH workers were selected randomly from each industry for this research study.

The physical parameters like anthropometric and body composition of the subjects were measured. A detailed questionnaire analysis based on modified Nordic questionnaire was carried out and different physiological parameters like heart rate and blood pressure of the workers were measured to assess the extent of work related physiological stress. The work mode, work behaviour and the entire work organizational arrangements were studied. The condition of the work environment was assessed by evaluating the thermal load, relative humidity, illumination level and sound level of the workplaces. On the other hand some workplace hazards life smoke, fumes, dust, condition of the floor etc were studied. Furthermore the different working postures of the subjects were taken into consideration for analysis by OWAS method. After analysis of postures, the centre of gravity of each hazardous posture was calculated and the location
of centre of gravity for each hazardous posture was pointed out by whole body segmental centre of gravity analysis method.

It was observed that almost all the workers are present in their respective occupations for many years. The workers of the unorganized sector have an erratic work schedule and more work fetch them more money. They are completely addicted to alcohol, smoking and tobacco chewing.

There is a distinct difference in the lifting pattern of these workers. The maximum load is lifted by the central market area workers (96.3 kg/lift by a single person), whereas, the frequency of lifting is stupendous among the brick kiln workers (367 times/day). Moreover with such a high frequency, they also travel considerable distance (44.2 m. each time with load). Thus although the amount of load lifted is inconsequential (9.6 kg./lift), but the frequency and the distance covered combine together to enhance the physical stress of the brick kiln workers. On the other hand railway porters and handcart pullers also handle heavy load manually (64 kg/lift and 84 kg/lift respectively) and have to travel a distance (116.2 m and 128.6m respectively) which increases their physical and physiological stress at work, as a result injuries and accidents occurs.

In case of organized sector, the workers have to lift heavy load with a high frequency. In heavy engineering industry, steel mills, jute mills and in construction industry the workers have to lift 55.32 kg, 40.45 kg, 60.22kg and 48.45 kg load each time respectively with a high frequency. But in construction industry the workers have to lift almost 50 kg. cement bag each time at a frequency of 103.21times a day. Moreover of all the workers involved in this study, these workers cover the maximum distance (48.4 m. each time with load) with the load overhead. In addition to this they are also required to climb a height of 1.86 m each time with the load overhead from the ground to the pouring level, which make their work process even more strenuous. This is evident from the alarming escalation of the mean heart rate to160 beats/minute after the completion of a single work cycle. In steel mill also the worker have to handle hand ladle filled with molten iron and have to travel a from furnace site to the pouring site with the load, at the
return path they have to carry the empty ladle weight about 20 kg, which enhances their physical stress.

The questionnaire analysis further revealed that accidents and injuries encountered in workers of both the sectors. Among unorganized sector the hand cart pullers (88%), railway porters 84%, the central market area workers affecting 80% and 74% of the brick kiln workers are affected by different types of accidents. In organized sector, 96% of steel mill worker, 92% of the construction industry worker, 84% of the jute mill workers and 70% of the workers of heavy engineering industry affected by different types of accidents and injuries. A significant finding is that although the construction industry and steel mill fall in the organized sector and the weight of each cement bag is maintained at 50 kg in the construction industry, even then a great percentage of the workers engaged in cement bag handling reported of their sufferings. These sufferings can be accounted due to adoption of awkward working postures and increased frequency of load handling. The analysis of work postures also reveal that most of the postures require some sort of correction as soon as possible as indicated by OWAS action categories.

The severity of load handling has been well documented from the IPC record and records from factory inspectorate office wherein majority of the MMH workers irrespective of their sectors, affected by different types of injuries and accidents. In all these records, it was revealed that the MMH work is most hazardous and injury and accident prone.

It is observed that the WBGT values for outdoor (unorganized sector) as well as that for indoor (organized sector) both exceed the threshold limit value. The relative humidity level in the central market area is found to be much higher than the recommended value of 65%. Thus to add to their agony, the thermal conditions in the central market area, steel mills and in construction industry exert a negative effect on their work performance which ultimately results in injuries, bodily damage and accidents.
From the data it is clearly evident that the sound level is not within the permissible limit in case of steel mill and brick kiln but slightly above in case of construction industry, heavy engineering industry and central market area. On the contrary in all cases the illumination levels is far below the recommendation levels.

While analyzing other environmental hazards like smoke, dust and fumes, it was observed that the MMH workers of both the sectors are reported about these hazards which affect their work performances and responsible for the occurrence of injuries and accidents.

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The thorough analysis of the obtained results followed by comprehensive discussions revealed that the central market area workers, handcart pullers of unorganized sector; workers of steel mills, construction industry and jute mills are the worst sufferers of MMH work related injuries and accidents organized sector and in the unorganized sector respectively. On comparing the results of these groups of workers, it is observed that both of the workers perform the most exhaustive and most gruesome load handling jobs.

In the construction industry, the existing workstation has been re-organized in such a manner so as to diminish the distance that the workers are required to cover with the load overhead and also to reduce their workload considerably. Moreover in such an arrangement the time factor has been significantly minimized and as a consequence the overall productivity of the company has been enhanced.

In the steel mill, one of the hazardous postures has been eliminated by modifying the existing work process. Overall work organization, work mode has been modified, with modification in some environmental conditions like by improving natural
illumination, reducing noise level and by providing some personal protective device occurrence of injuries and accidents has been reduced. In the existing workstation, the distance from the storage site of raw material to the core-making site is found to be too long. A new workstation is being designed where a new storage site for storing mixed sand has been selected near the core making area. This resulted in an increase in productivity of core making by about 30%.

However, since it is not possible for the MMH workers in the unorganized sector to leave their jobs because of the poor economic conditions of their family, so adequate precautions can be taken at work by using some low cost personal protective device or by changing the mode of load carrying to decrease injuries and accidents at work. The most important of them all is to improve the working postures adopted by the workers during different types of load handling tasks. They should take adequate rest pauses while at work and consume balanced diet at periodic intervals. This will reduce the early onset of fatigue and development of work related stress.