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Assessment of physical fitness and postural discomfort among assembly workers

Pragya Ojha and Deepa Vinay

Abstract
Awkward working postures have been found to be associated with decreased work efficiency which is crucial cause of body discomfort resulting from the restricted postures. This investigation presents a study on various working postures occupied in two wheeler automobile industry of SIDCUL, Pantnagar. The automobile industrial sector have major role in Indian economy and it is the place where work posture analysis is mostly neglected. The subjects were calibrated with the Harvard step stool test to determine their physical fitness index. For Posture analysis total 111 workers engaged in various process of assembling of bikes were selected and Rapid Entire Body Assessment was used to assess the body postures. The different activities of the workers were recorded by video and still photography, and these images were used for analysis. The results showed that Physical fitness index scores of maximum respondents i.e. 76.35 percent fell in the category of good score of Physical fitness followed by 33.33 per cent who had a very good physical fitness. The final scores of Rapid Entire Body Assessment during various working activities were found to be high. The findings revealed that there are ergonomic deficiencies in the planning and work method. The study recommended a proper implementation of ergonomics interventions program with awareness and training among workers to reduce the risks of WMSD.

Keywords: Automobile Units, Assembly tasks, Posture, Physical fitness, Rapid Entire Body Assessment

Introduction
As identified by Chung *et al.* (2001) [3], automotive assembly tasks are one of the most labour intensive industries, where workers are required to perform tasks repetitively in poor working postures due to the constrained work place, placing large amounts of strain on the musculoskeletal system. Assembly in the automotive industry still relies heavily on physical manpower and manual assembly despite the many advances in mechanization; hence the need to examine all aspects of the working conditions (Nussbaum, 2001) [4] as workers are required to adopt awkward working postures and handle loads (Chung *et al.*, 2001) [3] and to maintain these for the duration of the task, thereby increasing the risk of incurring MSDs (Carey and Gallway, 1998) [5]. These postures may also need to be held for a certain period of time, requiring static standing and restricted postures such as those found in machine operation and assembly work (Miedema *et al.*, 1997) [6]. The effects of static and awkward postures, with the added level, duration and variation of load, may also increase the risk of incurring MSDs.
Besides this, it is well known that physical fitness is an important element for daily human activities. Good aerobic and muscular fitness have been shown to be essential for workers attempting to optimize their operational field performance. It seems that recent technological advancements and mechanization have reduced physical fitness requirement of the workers working in the industries. Keeping the above facts in mind, the present investigation was planned to assess physical fitness and postural discomfort among assembly workers of automobile assembly workers.

Materials and Methods
Selection of sample
Total 774 emplyees were selected from two wheeler automobile industry of State Infrastructure and Industrial Development Corpo- ration of Uttarakhand Limited (SIIDCUL), Pantnagar for physical fitness test whereas, only 111 assembly workers were selected from two production department, i.e. vehicle assembly and paint shop for the Ergonomic Postural Assessment. This cross-sectional study was conducted in order to investigate the ergonomic risks involved in the automobile manufacturing industry. All the jobs were observed before start of the study and detailed job information was collected to ensure the completion of ergonomic risk assessment tools. A video recording and photographs were taken in different sections of assembling of parts of bikes.

Postural Analysis

Hignett and McAtamney (2000) [1] developed the Rapid Entire Body Assessment (REBA) tool for application in the health care and other service industries. REBA uses a similar approach as RULA, where posture, force, movement or action, repetition and coupling are assessed. It is thus a means to assess posture for the risk of WRMSDs. The tool considers critical areas of a job and for each task it assesses the posture factors by assigning a score to each region. The data obtained through assessment of the task is then entered on a scoring sheet which gives a REBA score for each task that indicates the level of risk and urgency with which action should be taken. Various criteria can also be used to select postures to analyze and the use of time sampling can also be utilized. REBA is more for the analysis of the whole body involved in activity, animate tasks and where postures are dynamic, static or where gross changes in position take place.

Assessment of Physical Fitness

The subjects were calibrated with the Harvard step stool test to determine their physical fitness index by using following formula:

Physical Fitness index = Duration of Stepping X 100/ Sum of 1st, 2nd & 3rd Minute recovery heart rate

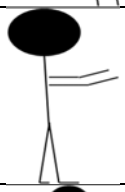
The physical fitness of the respondents was calculated and interoperated by using physical fitness index (PFI) score given by Verghese, *et al*. (1994) [2] and the respondents were ranked from poor to excellent.

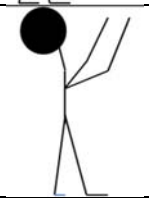
Result and Discussion

Postural analysis

The video was cropped every 27 seconds to get snapshots of the workers and these snapshots were analyzed to fill the scores in REBA worksheet. Later on stick diagrams were drawn from freezed frame video records and eventually subjected to analysis. The most frequent postures adopted by the workers were taken into consideration. For each task, posture factors were assessed by assigning a score to each region. Using the REBA worksheet, a score was assigned for each of the body regions like wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees. Then data for each region was collected, scored and compiled to assess the risk factor variables, by generating a single score that represents the level of MSD risk. It was observed that working postures i.e. One hand above the shoulder (Code 1), Stooping 30^0 (Code 3) and Twisted to preferred side (Code 5) were in the Medium risk where further investigation and soon changes were required whereas when the assembly workers required Standing Upright posture (Code 2) they were in Low risk of MSD and in that posture change may be needed. Further it was also assessed that in Stooping 60^0 and overhead working posture, High risk of MSD were involved and to solve the problem investigation and implementation of changes were recommended.

Table 1: Application of REBA for the Postural Analysis of the Assembly Workers

Code of Postures	Line Diagram of body postures	Name of the body Postures	Scores Of REBA	Action Category
1.		One hand above the shoulder	4	Medium risk, further investigation, change soon
2.		Standing Upright	3	Low risk, change may be needed
3.		Stooping 30^0	6	Medium risk, further investigation, change soon
4.		Stooping 60^0	8	High risk, investigate and implement change

5.		Twisted to preferred side	4	Medium risk, further investigation, change soon
6.		Overhead working posture	8	High risk, investigate n implement change

Physical Fitness of Employees

Earlier, fitness was commonly defined as the capacity to carry out the today's activities without undue fatigue. In the current context, physical fitness is considered as a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy to resist hyperkinetic disease and to meet emergency situations. Physical fitness is defined as the ability to carry out daily tasks with vigour and alertness without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies. Physical fitness comprises of two related concepts i.e. general fitness (a state of health and well being) and specific fitness (a task oriented definition based on the ability to perform specific aspects of sports or occupations). Physical fitness of respondents denotes that good Physical fitness leads to higher work efficiency and vice versa. On the basis of Physical fitness index scores, maximum respondents i.e. 76.35 percent fell in the category of good score of Physical fitness followed by 33.33 per cent who had a very good physical fitness, only 1.16 percent respondents and 0.51 percent were having high average and low average scores of Physical fitness respectively (Table 2).

Table 2: Physical Fitness of the Employees (n= 774)

Category of physical fitness score	Frequency
Very Good	170 (21.96)
Good	591 (76.35)
High Average	9 (1.16)
Low Average	4 (0.51)

*Figure in parentheses indicate the percentage value

Conclusion

On the basis of aforementioned facts we can conclude that assembly workers of automobile industries are unawareness about ergonomics. It was observed that due to assembly work the prevalence of musculoskeletal discomfort among workers was very high. The major cause of musculoskeletal discomfort was performing the assembling tasks in awkward postures.

According to REBA it can be concluded that in the working environment of two wheeler automobile industries there is need of ergonomic planning. The score of Rapid Entire Body Assessment was high which shows that workers are performing the assembly operations in poor posture which is not correct for workers health and performance. The score can be reducing by the adequate working postures of worker by ergonomic measures.

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