
Physiological Significance of Rest Allowences : It's Application in Industry

Ghosh P.C.

Director (Physiology&Ergonomics), Retired

Central Labour Institute, Sion, Mumbai.

Presently At: Defence Enclave, Air Force Station

6th Street, 5th Lane, 38, Mes Road, Avadi, Chennai-600 055

Email: ghoshpcg@gmail.com / pcg_ghosh@rediffmail.com /
ghoshpareshchandra@yahoo.in

ABSTRACT

High-intensity work can be specified as any physical activity that mobilizes contraction of large Muscle groups and requires oxygen uptake (VO_2) of at least 50% of the maximum oxygen uptake (VO_{2max}). The anaerobic energy-yielding metabolic process plays an increasing role in high-intensity work, because the lactate threshold occurring between 40% and 60% of the VO_{2max} for most untrained individuals [15]. In other words, the VO_{2max} and heart rate (HR) will increase continuously instead of reaching a steady state when someone is engaged in a high-intensity work task. The continuous increase in heart rate brings potential hazards and adherent problems associated with high-intensity activities [15]. To evaluate the workload in industrial practice, guidelines about acceptable workload duration for certain types of work is important. Several studies have suggested that the acceptable workload for an eight-hour workday is about 30–40% of the maximum aerobic capacity (VO_{2max}). The acceptable workload, which can be expressed by % VO_{2max} , is the workload that can be sustained by an individual for an eight-hour work day in a physiologically steady state and which will not cause fatigue or discomfort. For different workloads, the acceptable work duration should be changed accordingly. It is nice to see the common kitchen operation has also relevance to rest allowances.

We find from various literatures that many industrial operations are carried out in high energetic, hostile environmental conditions causing excessive physiological fatigue among industrial operators [1, 2, 3]. This excessive physiological fatigue is a main factor in reducing industrial productivity, high accident rate, more over low performance among industrial operators. Unless we address this issue industrial safety, health, productivity is in stack. Loss of industrial profit, inter industrial relation and many more. Other specialties are of no use in combating such high physiological fatigue, strains at shop floor [5,6] Most scientific way to tackle all such situation is considering rest allowances in all such operations [1,2,3,4]. All most all over the world rest allowances are practice in steel plant, forging, smelting shop, etc as routine harvesting much benefit, science it is restricted only some particular sections and appreciably administrative support much hue and cry is not seen.

Key words: Rest time; Exhaustion; High-intensity work; Heart rate; Oxygen uptake

INTRODUCTION

The complex, monotonous, physically demanding industrial operations are an important cause for developing fatigue in human systems, which ultimately resulted in decrement of human performance capacity. Fatigue is a complex phenomenon developed in human system when one makes an effort to do industrial operation in regular eight hours basis as work shift practiced

in industry. However, the development of fatigue in any effort either physical or mental varies with the intensity of job demand. Thus, one can see the development of fatigue is incremental if the working effort is increasing in nature. Thus, the exposure and the resultant force have a relationship, which is of vital importance for understanding this complex phenomenon [16]. The amount of physical exposure is measured in terms of various units like meter kg, foot-pound, British thermal unit, kilo ponds etc, which are inter convertible among themselves. Thus, one unit can be converted to another to know the amount of exposure the man is subjected to. This exposure is called the stress, stimulus or change of the environment, which will develop resultant fatigue or the strain in human system. In a case of metal activities it is called "metal fatigue". In case of physical work, it is called "physiological fatigue". It is a complex phenomenon developed in various systems of human beings, which ultimately causes the reduction of human performance capacity. The physical exposure to human system can be of any type like the physical, chemical, mechanical, electrical, thermal (Both man made, and natural), environmental whatever it may be [16,17,18] The concomitant exposure and involvement resultant effects are known as the strains developed in human system. Thus, the stress and the strain go simultaneously in development of fatigue in long run into human system. Once the development of fatigue is initiated then it is difficult to control unless we take care of the causing factors into confidence. As all of us we know that the human body is complex house of chemical laboratories (The digestive system), communications system (The nervous systems), data processing center (The brain), and mechanical power house (The muscular system), which are constantly involve in sustaining the life of all individual. The coordinated effort of all these systems and the others makes the successful human performance jobs, recreations, sprints, competitions etc.

In additions to these physical demands the environmental exposures of heat as tropical country is another problem. We need to tackle it from humanizing point of view so that at least made job human. Once all branches of science is failed no further improvement is possible only then rest allowances will be considered. Not before exhausting all options. It should not be used as regular basis rather a rare industrial situation it should be calculated and apply. Many proposal have been proposed by researchers but Murrall & spitzer proposal has physiological significant. Thus metabolic as well as other physiological parameters have been used to calculate rest allowances. Metabolic consideration has preferences as because of its stability, unbiasedness, easy to apply in field. A technique which is vital for industry has been discussed in full paper with industrial application. All proposals are based on human recovery pattern and how the physiological reactions are to be kept under control is the concept of human rest allowances. ILO has proposed a ready-made chart for industrial use. Most of our manual material handling operations it was found to be effective tools to reduce physiological fatigue among operators.

MATERIALS AND METHODS

It is a review article author has made for industrial use. During our study at CLI rest allowances was one of the topics which factory rules stipulated based on human physiological reactions. We at CLI have made an attempt to set standards for Indian industries. Extreme environmental condition physiological strains are beyond limits which can never be control by other means. We felt a rest allowance is the only solution in all such hostile environmental conditions. Many countries are practicing this in their industry. to generate interest among young researcher I have decided to present this paper in ISE annual conference at Vidyasagar University, Midnapur in 2013. I hope one important research area will emerge from this field.

RESULTS

The review has clearly indicated that the rest allowances is the most useful techniques which can be used in industry where situation are beyond safe limits as well as cannot be control by other branch of science. The administrative, economics, medical complications, human strain will be the main consideration before applying rest allowance for industrial operation. Use of safety appliances, physiological techniques are to be applied regularly at shop floor to keep human physiological fatigue within safe limits. This technique is to be applied only when all options are exhausted not before that at all. The psychological components of human fatigue need also to be considering though it is not a major contributing factor. Human physiological & psychological sate of fitness is essential for more precision, decision, rhythm, techniques, to perform industrial task properly. Psychological well being of operator is also paramount importance at shop floor.

DISCUSSION

Allowance refers to extra time allowed, beyond completion of the task itself. Personal time allowance - 4% - 7% of total time - use of restroom, water fountain, etc. Some allowances are necessary for health and long term efficiency (like rest breaks), others are pragmatically necessary, (like time for picking up dropped tools or consulting with supervisor), Delay allowance - based upon actual delays that occur. Fatigue allowance - to compensate for physical or mental strain, noise level, tediousness, heat and humidity, assumption of an abnormal position, etc.

Work-related interruptions

Machine breakdowns, Waiting for materials or parts, Receiving instructions from foreman, Talking to co-workers about work related matters, Rest breaks for fatigue, Cleaning up at end of shift

Non-work-related interruptions

Personal needs (e.g., restroom breaks), Talking to co-workers about matters unrelated to work, Lunch break , Smoke break, Beverage break, Personal telephone call.

Normal Time

The time to complete a task when working at normal performance $T_n = T_{obs} (P_w)$, where T_{obs} = observed time, T_n = normal time, and P_w = worker performance or pace

Normal Performance

A pace of working that can be maintained by a properly trained average worker throughout an entire work shift without deleterious short-term or long-term effects on the Worker's health or physical well-being, Normal performance = 100% performance, Common benchmark of normal performance: Walking at 3 mi/hr

Performance Rating

Analyst judges the performance or pace of the worker relative to the definition of standard performance used by the organization. Standard performance $P_w = 100\%$, Slower pace than standard $P_w < 100\%$, Faster pace than standard $P_w > 100\%$, Normal time $T_n = T_{obs} (P_w)$

Methods for computing standard times

Method 1: rest $ST = NT + NT \times \text{allowance} = NT (1 + \text{allowance})$

Method 2: Compute allowances as a percentage of task time. $ST = NT / (1 - \text{allowance})$

ST = Standard Time: the time in which you expect workers to complete an operation.

NT = Normal Time: time required to complete an operation for a given operator

OT = Mean Observed Time to complete an operation (from time study).

For an experienced operator who works at a 100% rate (R), $OT = NT$, and

$NT = OT \times R/100$ where R = the performance rating of the operator.

The complete reviews clearly has given an impression that more work is needed in this area to come to a definite conclusions with special reference to economics, administrative, medical complications, long term effects, and some other factors needs to be carefully consider before applying rest allowances technique. As we have seen earlier a blank cheque cannot be given to industrial physicians, administrator, and management personals to apply this technique for combating industrial fatigue, strains, psychological factors as and when demanded.

Based on the metabolic energy expenditure model, [13] provided the Following formula to determine a rest-time requirement for any given work activity:

$$R = T \times (W - S) / (W - BM), (1)$$

Where R is the total amount of rest required in minutes, T is the total work time in minutes, W is the average energy consumption of work in $\text{kcal} \cdot \text{min}^{-1}$, S is the endurance limit of energy expenditure ($5 \text{ kcal} \cdot \text{min}^{-1}$ for males, $4 \text{ kcal} \cdot \text{min}^{-1}$ for females), and BM is basal metabolism ($1.7 \text{ kcal} \cdot \text{min}^{-1}$ for males, $1.4 \text{ kcal} \cdot \text{min}^{-1}$ for females). Based on the findings of similar physiological methods, [2] also suggested a formula to predict the rest allowance (RA) for heavy dynamic muscular work. in industry:

CONCLUSION

Reviews has clearly ascertained the following conclusions as follows

1. More studies are require considering anthropometry, physiological charestericts to make it as standard procedure for industry.
2. More research in this field I invite young scientist to work in this area to make it national tools for industry.
3. Industrial physicians, managers, administrators etc must be made aware of physiological benefit a person can derive by applying this technique.
4. Industry must be aware the deleterious effect of all such environmental, physical, physiological, psychological factors at shop floor.
5. Suitable amendment must be effected in factories act for enforcement & compliance in industries.

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