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Perceived Fatigue and Physiological Workload of the Marble Cutting Workers working in Marble Industry of Kishangarh District

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Abstract

Fatigue is a prolonged feeling of tiredness and exhaustion which gets accumulated due to lack or rest, improper work habits, postures, lack of sleep and stretching and straining of muscles of the body. The physiological workload determines the physical or muscular effort carried by a worker to accomplish a task. The analysis of physiological cost of work plays a pivotal role in the process of carrying out ergonomic evaluations of any job.The sample was selected through purposive random sampling. 220 Marble Cutting workers were selected for the study. The data were collected through Questionnaire and observation method wherein the Questionnaire dealt with information on Fatigue and observation was conducted for gathering physiological cost of work. The findings of the study elicit that the respondents were facing Severe fatigue. The physiological cost of work of the respondents revealed that thetask was moderately heavy. The study will aid in policy making for ensuring the safety of the workers working in Marble cutting industries.

Keywords: Percieved Fatigue, Physiological workload, Marble Cutting Workers, Marble Industry.

Introduction

Fatigue is a non-specific symptom but one of the most common ones reported in several studies [Evans & Lambert (2007) and Jason et.al. (2010)]. It is defined as one's state of overwhelming, debilitating, sustained exhaustion and decreased ability to perform daily activities, and that cannot be relieved by rest (Fukada, 2004). Fatigue also can result in declines in worker productivity due to the debilitating nature of fatigue [Kant et.al, 2003].The analysis of physiological workload plays a pivotal role in the process of carrying out ergonomic evaluations of any job. The objective of applying ergonomic principles in work analysis is to maintain a balance between the work and the physical capacity of the worker. If the physiological cost of the work is less the worker is underutilized and there is a productivity loss hence the balance between the two is needed. (Singh, 2013). Determining the physiological cost of work of the marble cutters would assist in utilizing their work productivity efficiently. Thus, a need was felt to find out the physiological cost of work of the marble cutters.The present study aims to assess the physiological cost of work and perceived fatigue of the Marble cutting Workers. The findings of the study will aid in policy making of unorganized workers. The study will also provide an insight of the fatigue experienced by the Marble cutting workers which can aid in restructuring the job design if necessary.

Methodology

The present study was conducted in the international hub of marble i.e. Kishangarh Tehsil of Ajmer district of Rajasthan, India. Kishangarh is a village in Kotri Temple in Bhilwara District of Rajasthan State, India. It belongs to Ajmer Division. The unit of enquiry for the present study were the Marble Cutters working on the Marble Tile Cutting Workstation in the Marble Industry. The sample comprised of 220 marble cutters working on the marble tile cutting workstation in the marble industry. The respondents for the present study were healthy and did not suffer from any chronic or acute diseases at the time of data collection the care was taken to select the workers who were regular. The workers aged above 50 years were also excluded from the sample to avoid bias. The respondents

selected for the study had minimum two years of experience and above. Purposive sampling design was utilized for selecting the sample. The Physiological Cost of Work of the Marble Cutting Worker was assessed on the basis of energy consumed (kj/min) and Heart Rate (beats/ min) of the worker while cutting one standardized size of marble slab. It was measured by the severity of Physiological Workload as given by Varghese et.al. 1994. The Perceived Fatigue was the Fatigue experienced by the workers after work.

Physiological Workload

For collecting data of physiological workload, digital heart rate monitor was be used to measure the heart rate (beats/ min). The Heart Rate Monitor was used to measure the heart rate stresses during the activity. Later the Heart Rate Monitor was tied and the watch started to record the heart rate of the worker while working for 30 minutes. Three readings were recorded of the respondents to derive an average working Heart Rate.

Based on the records of heart rate monitor, and energy expenditure for the activities, inferences were drawn by using the formula.

Energy Expenditure (kj/min)= 0.159xAverage Working Heart Rate (beats/min)-8.72

Table 3: Classification of Physiological Workload According to Severity of Work Load

Physiological Workload	Varghese et.al. 1994 Energy Expenditure
Very light	Up to 5.0
Light	5.1-7.5
Moderately heavy	7.6-10.0
Heavy	10.1-12.5
Very heavy	12.6-15.0
Extremely Heavy	>15.0

Perceived Fatigue

The perceived fatigue was measured by the researcher through prevalidated FACIT Scale. The FACIT Fatigue Scale is a short, 13-item, easy to administer tool that measures an individual's level of fatigue during their usual daily activities over the past week. The level of fatigue is measured on a four point Likert scale (4 = not at all fatigued to 0 = very much fatigued) (Webster et al., 2003). The FACIT tool has been translated in more than 45 different languages permitting cross-cultural comparisons. In a 2007 study, (Chandran et al., 2007) the FACIT Fatigue Scale was found to have high internal validity (Cronbach's alpha = 0.96) and high test-retest reliability (ICC = 0.95).

Results

Fatigue is extreme tiredness that can manifest as physical weakness or mental exhaustion. It is characterized by decreased energy, motivation and difficulty concentrating. Fatigue is a non-specific symptom but one of the most common ones reported in several studies (1) (Berggren, & Christensen, 1950). It is defined as one's state of overwhelming, debilitating, sustained exhaustion and decreased ability to perform daily activities, and that cannot be relieved by rest (Malhotra,1962). The energy expenditure is the amount of energy (or calories) that a person needs to carry out a physical function such as breathing, circulating blood, digesting food, or a physical movement.

Perceived Fatigue

Fatigue can be acute or chronic. The data were collected through FACIT scale version 4. The FACIT Fatigue Scale is a short, 13 item tool that measures an individual's level of fatigue during their usual daily activities over the past week. The level of fatigue is measured on a four point Likert scale. The items are scored as follows: 4=Not At All; 3=A Little Bit; 2=Somewhat; 1=Quite A Bit; 0=Very Much, EXCEPT items #7 and #8 which are reversed scored. Score range 0-52. A score of less than 30 indicates severe fatigue. The higher the score, the better the quality of life.

The data in the table 1 reflected that almost half of the respondents (50.45%) were found to be severely fatigued. The data is supported by the findings of a study conducted in China by Lin et.al. (2015) on community health in Shunde (Guangdong Province, China) revealing that approximately 30 per cent of the respondents experienced fatigue. The fatigue was associated with age, marital status, employment status, regular exercise, number of self-reported chronic diseases, number of individual's children and hospitalization in the last year in middle-aged and elderly males. Zhang et.al. (2015) also found while surveying presence of fatigue among the 606 construction workers of US, it was revealed that 49 per cent reported being 'tired some days' in the past 3 months and 10 per cent reported 'tired most days or every day'.

Table 1: Distribution of Respondents According to the Perceived Fatigue experienced by them

n=220

Level of Fatigue	f	%
Severe Fatigue (Below 29) (Below Mean)	111	50.45
Less Fatigue (More than 29) (Above Mean)	109	49.55

Physiological Workload

Physiological Workload refers to the physical or muscular effort required on the part of the worker to accomplish a task or an activity. From the physiological point of view, the job demand or workload refers to the demands placed on the cardio-respiratory system determined from the energy cost and the cardiac cost of work.

The period during which the activity continuous is known as the 'work period' and when the activity is stopped and physiological functions returns to resting level is known as the 'recovery period'. The data were gathered by using he heart rate method. The use of this method has been advocated by many researchers in the field of physiology (Berggren and Christensen,1950; Malhotra et.al. 1962) and is now used worldwide as a measure of physiological workload in industries and other field situations.

The respondents were allowed to sit and rest for five minutes. Later the Heart Rate Monitor was tied

and the watch started to record the resting heart rate for five minutes. The respondents were asked to start the activity for 30 minutes after taking a rest for five minutes. After 30 minutes the respondents were requested to stop the activity and allowed to recover for five minutes and the recovery heart rate was then recorded. Thereafter, the heart rate monitor was stopped. Based on the records of heart rate monitor, total cardiac cost of work (TCCW) inferences were drawn on the basis of classification given by Varghese et.al (1994).

The data in the table 2 revealed that for slightly less than two third of the respondents (61.82%), the physiological workload was found to be moderately heavy of the task performed by the respondents. 34.54 per cent of the respondent's physiological workload was recorded heavy for the task performed by them. It was also interesting to note that very few respondents (3.64 per cent) physiological workload was computed as light for the task performed by them . The findings of the present study were supported by a study conducted by Santini et. al in 2012 in Italy revealing that the physiological cost of work was high among the construction workers. An assessment of physiological stress parameters of female workers engaged in selected cooking activities by Bhatt et.al (2011) revealed that according to the workload classification given by Varghese et al. (1994), the physiological workload of the activities can be interpreted as light activity for rolling and dish washing, whereas cutting and grating carrots and kneading dough as moderately heavy activity.

Table 2: Distribution of Respondents According to the Physiological Workload

n=220

*Physiological Workload	f	%
Light (91 – 105 Heart Rate beats/min)	08	3.64
Moderately Heavy (106 – 120 Heart Rate beats/min))	136	61.82
Heavy (121 – 135 Heart Rate beats/min))	76	34.54

Source: Varghese Et.al. (1994)

Conclusion

The findings conclude that the respondents were experiencing fatigue. The respondents physiological workload was also computed to be moderately heavy and heavy. The work structure can be reexamined and redesigned in order to lesson the fatigue and workload of the respondents. The workers must be given facility for rest breaks so that they can relax and work thus increasing their efficiency and reducing their fatigue.. The owners of the industry must take certain actions in providing rest breaks, and training regarding handling posture, avoiding repetition of work thus reducing perceived fatigue.

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