

# The Effects of Job Demand on Work Productivity and Perceived Discomfort Level While Performing Manual Handling Task

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**Abstract:** *This paper aims to investigate the effects of job demand on work productivity and perceived discomfort level at different intensity levels of job demand. Twenty subjects involved in this study comprised of 10 males, and 10 females. All subjects performed an experimental at two different intensity levels of job demand. The data of work productivity and perceived discomfort level were recorded during the task. The results showed that the higher the intensity level of job demand, the higher the work productivity and perceived discomfort level. It can be concluded that working at higher job demand results in higher worker productivity, but proper planning on task design should be implemented to avoid the unwanted risk that will lead to the risk of WMSDs.*

**Keywords:** WMSD, Job Demand, Manual Handling Task.

## I. INTRODUCTION

Job demand can be defined as physical, psychological, social or organizational aspects of a job or task which require endless and continuous effort (Schaufeli et al., 2004). A job demand can lead to positive as well as negative outcomes but depending on the individual's ability and demand itself to manage with it. On top of that, positive responses may be stimulation, motivation or satisfaction while negative responses can be anxiety, fatigue or depression (Schaufeli et al., 2004). Essentially, job demands are well known as one of the most common causes of stress related to work (Wu, 2016). Long working hours, work-shift, high time pressure and unpleasant physical conditions can lead to stress and bad consequences. Job demand can be categorized into four types such as quantitative demands, cognitive demands, emotional demands and physical demands (Road, 2010). In the ergonomic principle defined in the ISO 10075 that categorizes four main categories of sources of job demands such as task requirements, work equipment, physical work environment, social and organizational factors.

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Task requirements are related to job or task content and control, workload and work schedule. As for work equipment, it is related to ergonomic workplace facilities. Meanwhile, physical work environment is related to lighting, sound, climate conditions, smell and weather conditions. Furthermore, social and organizational factors are a relationship among employee, organizational principles and leadership style (ISO, 2016).

Job demands cause an individual to experience mental strain as consequences when the individual is confronted with it. There are two types of effects when it comes to job demands which related to work productivity which is impairing effect in short term and impairing effect in long term. According to 10075, stated that this impairing effect of mental strain is mental fatigue, monotony, mental satiation and reduced vigilance.

The other one is impairing effect is in the long term. The effect of mental strain is more on a serious mental disorder that may lead to various negative outcomes such as physical illness, labour turnover, and early retirement. Besides that, this effect also can cause the risk of sleep disturbance, infectious disease, asthma, the risk of stroke and coronary heart disease (Road, 2010). In fact, the job demands are found to be correlated with work productivity.

Work productivity can be worst or can be improved depending on job demand given to the individual to complete their task. Usually, any organization has its own specific standard time of production to produce its product per hour (Shikdar et al., 2003). The scenario could lead to physical fatigue and perceived discomfort which may contribute to negative consequences on work productivity for the long-term effects due to a reduction in the working efficiency. Thus, it is important to investigate the relationship between job demand and work productivity in order to improve task design in order to optimize work productivity and reduce physical fatigue and discomfort concurrently.

## II. METHODOLOGY

### Experimental Task

An experimental task is performed to collect data on the work productivity based on two different job demand intensity levels which are low and high level. Each intensity level has been conducted for 30 minutes. The task selected is an industrial-based, manual and repetitive task which is an assembly of sleeve anchor.



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## Subjects

Twenty healthy subjects, 10 males and 10 females were involved in this study. The average ages for the subjects were between 18 to 24 years old. The subjects have been ensured to have no previous history of musculoskeletal injuries.

## Experimental Task Procedure

Subjects were required to perform the selected task which is the assembly of sleeve anchor within 30 minutes. During the experimental task, the data of work productivity based on three different job demand intensity level is recorded. By referring to the pilot test, the average time for normal standard time is 10 seconds for every assembly of sleeve anchor. Therefore, for low-intensity levels, it must be 20% more than the normal standard time which is 12 seconds. Meanwhile, for high-intensity level, it must be 20% less than the normal standard time which is 8 seconds. Then, work productivity is calculated based on quantity per hour. The target work productivity for low-intensity level is 150 units meanwhile for high-intensity level is 225 units. After completing the experimental task, the subjects need to rate the discomfort level they experienced during performing the task. Borg's Scale (Table 1) has been used to assess the discomfort level at different job demand intensity levels.



Fig. 1 The experimental task conducted by male and female subjects

Table.1 Borg's Scale

The Borg General Scale		
0	---	nothing at all
0.5	---	extremely weak (just
1	---	very weak
2	---	weak
3	---	moderate
4	---	somewhat strong
5	---	strong
6	---	

7	---	very strong
8	---	
9	---	
10	---	extremely strong

## Data Analysis

The data collected has been analysed using appropriate tools. The relationship between work productivity and perceived discomfort level has been figured out.

## III. RESULTS

### Work Productivity

The results of work productivity (mean) for low and high levels intensity of job demands are shown in Table 2. Out of twenty subjects, 85% of the subjects achieved the target at the low-intensity level. Meanwhile, for high-intensity level, only 30% of the subjects achieved the target. For an average of overall work productivity at low-intensity level, the average is 14.7% more than the target. As for high-intensity level, the average is 4.4% less than the target.

Table. 2 Mean work productivity for two different intensity level of job demand

Intensity Level of Job Demand (Production Standard)	Overall Productivity (Mean)	Work
Low	172	
High	215	

Table 3 shows the comparison of average work productivity at two different intensity levels for both males and females. It can be seen that the average output for overall work productivity at high-intensity level is higher than low-intensity level. This is aligned with the findings of previous studies (Nur et al., 2016; Shikdar et al., 2003) whereby the output of work productivity is higher when the manufacturing workers are at the higher level intensity of job demand.

Table. 3 Mean work productivity for two different intensity level based on gender

Gender	Work Productivity (Mean)	
	Low Intensity	High Intensity
Male	161	206
Female	172	215

### Perceived Discomfort Level

In this study, the perceived discomfort level has been measured using Borg's Scale right after the subjects completed the experimental task. Based on data presented in Table 4, it can be seen that the average perceived discomfort at a low-intensity level of male subjects ranges between 2.5 and 4.3 meanwhile for female subjects is rangesbetween1.3 to 2.6.



The results show that the average perceived discomfort level for male subjects is higher than female subjects. Similar results observed at high-intensity levels as presented in Table 5. The results indicated that female subjects have higher resistance to having perceived discomfort compared to males. These findings are supported by the findings of Zhang et al., (2014) where females were found to have more resistant muscular fatigue than the males in task performance.

**Table. 4 Average Perceived Discomfort Scale at Low-Intensity Level based on Gender**

Body Part	Average Perceived Discomfort Scale	
	Male	Female
Neck	3	1.5
Left Hand	2.5	1.4
Right Hand	3.7	2.6
Lower Back	4.3	1.3
Shoulder	3	1.3

**Table. 5 Average Perceived Discomfort Scale at High-Intensity Level based on Gender**

Body Part	Average Perceived Discomfort Scale	
	Male	Female
Neck	3.8	1.5
Left Hand	3.1	2.2
Right Hand	4.7	1.6
Lower Back	5.1	2
Shoulder	4.5	1.4

#### IV. DISCUSSION

The aim of this study is to investigate the effects of job demand on work productivity and perceived discomfort level at different intensity levels of job demand. There are ten subjects involved in this study, comprised 10 males and 10 females. All subjects have no history of MSDs. The work productivity of the workers is recorded during the experimental tasks. The results showed that work productivity was found to increase at higher intensity levels of job demands. The results also revealed that the higher intensity level of job demands, the higher the perceived discomfort level.

As the experimental task has been done involving male and female subjects, there are slight differences in the results based on gender. The work productivity of male subjects was between 137 and 189 units at low intensity level of job demand. According to the target of work productivity at low-intensity level, 150 units of sleeve anchor must be achieved. The result showed that 20% of the subjects cannot manage to achieve the target. However, the average of work productivity for low-intensity level is still 7.3% higher than the target. Meanwhile, for high-intensity level, it can be seen that the average is 8.4% less than the target.

The work productivity of female subjects at low-intensity level was between 134 and 229. At the high-intensity level, work productivity was between 190 and 263. The average work productivity at low-intensity level for a female is 183

meanwhile for the high level is 224 respectively. The female work productivity is higher in high-intensity level than low-intensity level. The overall results showed that work productivity at higher intensity level is higher than the lower intensity level of job demand.

The perceived discomfort level is measured based on the Borg's Scale rating. The results obtained comprised of perceived discomfort level, categorized by gender at low-intensity and high-intensity levels. The average perceived discomfort level at low-intensity level for male subjects for neck, left hand, right hand and shoulders are at moderate scale ranged from 3 to 3.7, indicating that the subjects started to feel moderate to somewhat strong discomfort. On the other hands, the subjects tend to feel discomfort at their lower back which is showed by the highest average of perceived discomfort level at lower back compared to the other body parts with average scale 4.3. The female subjects have been experienced less discomfort at neck, left hand, lower back and shoulder during low-intensity level. The range of average discomfort level was from 1.3 to 1.5 which considered the subjects were really at ease when doing the experimental tasks. Despite that, the female subjects experienced the highest perceived discomfort level at right-hand with the average scale 2.6.

At a high-intensity level of job demand, the average perceived discomfort level increased for each part of the body for male subjects. The lower back showed the highest value (5.1) compared to other body parts at the low-intensity level, indicating that the male subjects experienced hard and strong discomfort level on their lower back while performing the task. The female subjects showed the highest perceived discomfort level is at left hand during high-intensity level of job demand. It is contradicted with the result for the low-intensity level where the highest average perceived discomfort is observed at right hand.

The overall result of this study showed that male subjects experienced higher perceived discomfort than female subjects in both intensity levels of job demand. The results indicated that female subjects have higher resistance to having perceived discomfort compared to male. These findings are supported by Zhang et al., (2014) where females were found to have more resistant of muscular fatigue than the males while performing similar tasks.

#### V. CONCLUSION

In conclusion, work productivity increased as the intensity level of job demand is higher. The perceived discomfort level also getting higher at high intensity level of job demand which could lead to the higher risks of WMSDs. The perceived discomfort level experienced by male subjects is found higher compared to female subjects. However, both genders showed increasing pattern of perceived discomfort level as the job demand increased. Working at higher job demand results in higher worker productivity, but proper planning on task design should be implemented to avoid the unwanted risk that will lead to the risk of WMSDs.



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The results of this study can be used as references in order to plan for the optimum work productivity and lower the risks of WMSDs simultaneously.

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