

Job Stress as a Function of Human Factor Engineering

Abbas Babaeinejad¹, Anahita Hosseininasab², Soheila Shamsadini³

¹Member of Scientific Board, Department of Management, Islamic Azad University, Kermanbranch, Kerman, Iran

²Graduate Student of Public Management, Department of Management, Islamic Azad University, Kermanbranch, Kerman Iran

³M.A.Degree in Business Management, Department of Management, Science and Research Branch, Islamic Azad University, Kerman, Iran

ABSTRACT

The purpose of this present paper is to study a relationship between human factors engineering (ergonomics) of job environment with job stress of employees in the private companies of Rafsanjan. A volume-sample is about 113 employees of these companies.

For collecting data, two ergonomic questionnaires of job stress and environment had been used. Data analysis was done by correlation tests of Condell and Spearman.

The obtained findings have been shown that there is a relationship between ergonomics of job environment and job stress of employees. And in the sub-hypothesis, it was determined that there is a relationship between job-physiology and engineering psychology with stress. But there is not a relationship between anthropometry and job-biomechanics with the stress of employees. At the end, some suggestions were presented for the further research in this field.

KEYWORDS: ergonomics, anthropometry, job-physiology, job-biomechanics, engineering psychology, job stress

INTRODUCTION

Industry & technology have caused considerable changes in different fields and they made the modern world. Humans overcame some of problems by these two tools and gained the more abilities (*Kechuian, 1997; 2*).

Work or job is the essential need of life although the development of technologies and sciences increased the diseases (*Miri et al., 2008; 2*).

During the past years, the vital role of ergonomics has been determined in decreasing the skeleton-muscular diseases, increasing productivity, improving the quality, job-life, security and total efficiency of organizations. The ergonomics' experts improved the efficiency of systems by optimizing well-fit between human-machine and environment.

In the present time, the importance of ergonomics has increased significantly and was changed into a strategy for improving the efficiency of system, providing an appropriate job, preventing the diseases and events from job and also improving the efficiency and human performance. In the new generation of ergonomics, we believe that there cannot be ergonomics without organizational and management considerations, therefore, for introducing ergonomics, considering the organizational culture and management system is necessary (*MoetamedZadeh, 2003; 1*).

When the industrialization happened, the pattern of diseases which threatens the human health has changed; as from the mid-20th century, we can observe the decrease of infectious diseases and increase of diseases and related events of life such as cardiovascular diseases and skeleton-muscular ones. The other event which threatens the human health in the industrial world is job-diseases; means diseases which are either caused by the available factors in the job-environment or intensified by the job-factors (*Ganji Pour, 2005*).

Nowadays, material wealth, in general, is the result of using technical knowledge and in particular, is the result of knowledge toward science and technology. In this case, what is important in social development associated with constant economical growth is to adjust (accommodate) the technical knowledge with the need of users and the related social and cultural conditions. Some of the evidences in the developing countries have shown that the lack of fitness between technology and its users resulted into the negative consequences such as low level of products' quality and high level of damages from the jobs (*Mardukhi, 1996; 5*).

Job damages cause the physical, psychic, emotional and social discomforts and finally due to these, the organization losses its active human force and sustains the great costs (*Mosadeghi Rad, 2004; 4*).

In the life of all individuals who are working, there is stress which imposes psychic pressure on the in various ways. Job changes such as organizational changes, salary and wage changes, job promotions, decrease or increase of

*Corresponding Author: Abbas Babaeinejad, Member of Scientific Board, Department of management, Islamic Azad University, Kermanbranch, Kerman. Iran Email:babaeimanagement@yahoo.com

human force and social events impose more pressure on the individual as he/she faces disorder, anxiety, and worry (Alavi et al., 2009; 21).

Psychic pressure resulted from jobs such as stress can cause the physical and psychic events for the individual and endanger his (her) health, threat the organizational goals and also decreases the individual's performance (Davis & New storm (translation), 1991; 298).

STATEMENT OF PROBLEM

Based on the statics of ILO (*International Labor Force*), 250 million events happen in the world annually in which 335000 person lose their life (as accidents). Also, there are about 160 million job-diseases in the world which cause the death of 1,110,000 individuals. And 4% of National Gross Product (NGP) in the world due to these events loses. Ignoring the safe issues and hygiene conditions or health of job causes the considerable economical losses which affects the productivity (Sharei, 2006; 3).

The rate of job-events which leads into the death is increased about 3000 to 4000 times in the developing countries and these events are unintentional. In our country, about 14000 job-events happen, annually (Akbari&Naghavi, 2004; 3).

Unfortunately, the traditional approach of management in order to respond the issues such as designing the job-environment, maintaining the labor force, improving the efficiency and productivity of labor force, decreasing the energy consumption, increasing the speed, accuracy and safety, decreasing the rate of events (from job) in the high-competitive and global market is insufficient and the managers of present organizations must consider these issues seriously.

Measures such as adjusting the job with worker or employee based on the personal differences, improving the ways of doing jobs, time standards of doing works which provides the expectations of employers, recognizing the abilities and limitations of labor force, responding the demands of consumers based on their physical and psychic needs and limitations increase the efficiency and relief of labor force and also consumers (MosadeghiRaad, 2004; 33).

Job in the life of an individual is an important part of his/her life which was considered by most of researchers. Ignoring the revenue leads into or satisfies the effectiveness of some of the humans' basic needs such as psychic and physical practice, social relations, value-feeling, self-confidence and competency-feel although job is the main source of psychic pressure (Dehshiri, 2004; 55).

Since the ergonomics is about a relationship between human, environment and tools, so it tries to manifest the efficiency in order to accomplish the evolutionary aims of job in the present complex system of technology by determining an interaction between these three factors. The main task of this science is to determine this issue which part of human job pressures (which were resulted from the technical conditions' changes in the new situation) must be changed or remained and also how we can use the special abilities of human in this field (Fadavi, 1998; 56).

In general, most works are being done by humans. Assigning these works to the humans in different countries is different as this rate in the industrial countries is less. But in Iran, the number of researches in this field is not more. The human error is the cause of 80% of job events which can be the result of job stress which is in association with most of diseases and job environment problems. This relationship was confirmed for the cardiovascular, skeleton-muscular diseases, blood pressure and the other ones (Souri, 2006; 54).

Doing the operations based on the ergonomics principles and the triple factors as human, organization and technology can ensure safety and efficiency in the organization which increases the productivity and has a considerable effect on increasing production, decreasing the medical and treating costs, decreasing the neurotic and psychic pressure, increasing job satisfaction, increasing the productivity and in general increasing the total revenue and economical benefits (MosadeghiRaad, 2004; 6).

Development, competition, use of technology and its development, and change of employees' behavior increase the stress. Job-health is the main problem in the economical decrease in the entire world (Ghafari et al., 2009; 8) which can lead into disorders such as behavioral, medical and psychological ones among the people.

In this case, the behavioral changes such as alcohol & drug abuse, and also increase of cigarette or smoke provide the field for job events and aggression is the first symptom of stress. On the other hand, the psychological consequences of job stress are being emerged in a form of family problems, sleep disorder and depression. Medical problems from job stress represent themselves as the predisposition of a person to the types of diseases and also the criticalness of sexual symptoms from these diseases in these individuals (Samari&LaliFazzy, 2004; 22).

There are many questions in this field such as how the employees, while they are working, do their work (in which physical positions)? Is the way of doing the works, based on the ergonomics' principles, is right? How we can decrease the employees' stress? What is the relationship between ergonomics of job environment with job stress of employees, in particular the employees of Rafsanjan private companies? Therefore, based on the above mentioned points, the main questions that must be answered as the following:

- What is the extent of using ergonomic principles in these companies?
- Whether the available and required tools in these companies have a good desirability?

- What is the extent of stress among the employees?
- Which field of ergonomics science is in relations with stress?
- Which field of ergonomics science was considered more than the other branches?

And answering them needs a practical and research work.

Theoretical Framework

How to design an office can affect the way of action and reaction of people and their attitude to their jobs (ShahririAhmadi, 2007; 204).

Good lightening with the appropriate design in the work-environment is a main factor in increasing the quality of products, industrial productivity, the performance of practitioner and his convenience (Samadi, 2006; 139).

Due to many reasons, the work-environment is a desirable field for grow of stress seeds. During the past years, this issue and the jobs which may provide conditions that cause the psychic pressure for the employees of organizations were considered. In job-stress, in addition to the factors which depend on the environment, the personal factors such as personal characteristics and interactional actions which happen among these factors (environmental and personal) play a role (Ahmad Poor, 2009; 1).

Critical arrangement of work and stress create an ineffective effect in the psychic or spiritual and physical health of employees and lead into a decline of organizational productivity (Casc Yap & Sinha, 2008; 2).

In a work-environment, there are three factors which cause stress such as physical, organizational and social-psychological factors.

The physical factors include low quality, inner weather, noise, vibrations, inappropriate lightening, stop, undesirable places for seating, the bad gestures, repetitive movements, and the other ergonomics problems. Technological developments and automation of tools were not associated with development in the field of ergonomics.

The diseases which are important in ergonomics are sever traumatic diseases such as skeleton-muscular and neurotic systems and they happen as being exposed the movements such as the moves of wrist and back. These damages or works which are being done by hands and also in the offices as the works are being done automatically are current and the following points refer to their reasons:

- bad physics of body
- stable physical conditions of body
- require to more force in order to do work
- repetitive moves with more frequency
- insufficient time in order to rest among the repetitive moves
- Cold temperature and vibrations (Shareii, 2006; 25-26).

Nowadays, by considering the automatization of life, the factors which damage job have been changed, significantly. For example, some of the heavy loadings are being done by machines and the employees should not do these works. But on the other hand, this kind of life was caused different problems for the humans such as maintaining the long term static postures in which some of them are associated with keeping the objects in the hand (Kohalaeii et al., 2009; 9).

Development, promotion, competition, use of technology and changes in the employees' behavior increase stress. Job health problem is a main factor in decreasing the economical gain all the world (Yan Cho, 2004; 262).

Ergonomics is a multidisciplinary science which is directed toward four categories means engineering psychological, job physiology, job biomechanics and anthropometry (Sadeghi, 2000; 11).

Engineering psychological includes the environmental-physical and chemical factors such as noise, lightening, vibration, water, weather and chemical substances which affect the safety, security and comfort of people (Samadi, 2006; 124).

High noise, bad lightening, low and high temperature, crowd, shortage of private places, and disability make stress in privatization of job environment (Vahabi, 2006; 11).

The task of physiology is that it measures the level of hardness/complexity in works and makes it appropriate to the abilities and power of an individual. This issue leads into the decrease of stresses which threats and individual (Seyyedi, 2008; 2).

Stress or physic pressure causes disorder in the metabolism, increases the heart rate, blood pressure, causes headache and expose him/her to the heart attacks (Robins (translation), 2006; 426).

In the biomechanics sciences, the rules of physics and engineering concepts are being used for describing the movement of different parts of a body and the imposed force on them during the daily activities (ShariariAhmadi, 2007; 134).

A resulted pressure from the stability of a body or its repetitive moves on the body-muscles leads into a local exhaustion in them; in other words, this pressure decreases the activity and efficiency of muscles (Samadi, 2006; 42).

Biomechanical methods are directed towards the physical balance between human and his mechanical system and they are about the tools, equipments and devices of work facilitation in this case (Mir Sepasi, 1996; 442).

Sitting on a chair and relaxing the muscles is one of the ways for decreasing stress (Moghimi, 2006; 442).

Anthropometry is about a systematic measuring of body by using the measuring tools (Abarghueei, 2009; 2).

By considering that in some works such as administrative works and mostly the works as the employees must spend their time on behind a desk, synchronizing and harmonizing some features, the height of chair and table based on the anthropometrical dimensions of a body is very important and it is necessary to mention that most skeleton-muscular problems are being resulted from the un-standardization of this feature because a table with short height causes the lean/bend of an individual and the other problems such as aches in back, neck and shoulders but a table with long height causes the aches in elbows, scapula/shoulder and neck and also, the unsuitability of chair height (size), its back and its seat can be a main reason of skeleton-muscle problems in the jobs (Heydari&Rafiei, 2009; 8).

Muscles' flexibility, muscles of individuals and being comfort when they are working such as doing sport are effective in decreasing stress (Moghimi, 2006; 442).

Hypothesis

Main Hypothesis

There is a relationship between ergonomy and job stress of employees in Rafsanjan Private Companies.

Sub-Hypothesis

- 1- There is a relationship between job biomechanics (studying the mechanical features of body) of employees and their job stress.
- 2- There is a relationship between job physiology (analyzing the work from the physiological view) of employees and their job stress.
- 3- There is a relationship between engineering psychology (processing the information of work) of employees and their job stress.
- 4- There is a relationship between anthropometry (adjusting the work-place dimensions with the dimensional features of a worker, employee or practitioner) of employees and their job stress.

METHOD

The present paper based on its aim and subject is a functional and based on its nature is a correlation study. Its statistical society contains of all employees of Rafsanjan Private Companies about 113 individuals. For determining the sample volume, sampling method with *Cochrane Formulae* with a possibility of 5% error and confidence level of 95% was used. In this paper, for collecting data and information, two questionnaires which were distributed among them randomly, were used.

Also in this study, due to anonymous of ergonomics' evaluation questionnaire of job environment, *Coronbakh Alpha* in order to determine the reliability and validity was used as .0.87 for reliability and 0.94 for validity were obtained. For determining the validity, these questionnaires based on the subject and the related hypothesis were presented to 5 professors of management field as the validity of job environment's ergonomics was 0.92 and the validity of stress questionnaire was about 0.90. Then, for studying the related hypothesis and their relationship, Condell and Spearman Correlation Test were used. All data analysis was done by SPSS Software.

RESULTS

Main Hypothesis

By considering that the Correlation Coefficient of Condell and Spearman between these two variables were -0.162 and -0.189 respectively and their significancy were 0.034 and 0.039 respectively, therefore, the zero-hypothesis based on a lack of relationship between these two variables is being rejected (in the level of 0.05). It can be concluded that this relationship is inverse; means that by increasing the job environment ergonomics in these companies, the job stress of employees decreases (negative correlation coefficient).

Table: calculation of correlation level and its significance

Frequency	Spearman		Job estress			Job Environment Ergonomics
	significance	correlation coefficient	Frequency	Condell significance	correlation coefficient	
113	0.039	-0.189	113	0.034	-0.162	

Other Hypothesis

1st Hypothesis

By considering that the Correlation Coefficient of Condell and Spearman between these two variables were -0.093 and -0.120 respectively and their significance were 0.301 and 0.247 respectively, therefore, the zero-hypothesis based on a lack of relationship between these two variables is not being rejected (in the level of 0.05).

Job stress						
Spearman			Condell			Job Environment Ergonomics
Frequency	significance	correlation coefficient	Frequency	significance	correlation coefficient	
113	0.247	-0.120	113	0.0301	-0.093	

2nd Hypothesis

By considering that the Correlation Coefficient of Condell and Spearman between these two variables were - 0.173 and -0.197 respectively and their significance were 0.27 and 0.043 respectively, therefore, the zero-hypothesis based on a lack of relationship between these two variables is being rejected (in the level of 0.05). It can be concluded that there is a negative relationship job-physiology and job stress (negative correlation coefficient).

Job stress						
Spearman			Condell			Job Environment Ergonomics
Frequency	significance	correlation coefficient	Frequency	significance	correlation coefficient	
113	0.043	-0.197	113	0.27	-0.173	

3rd Hypothesis

By considering that the Correlation Coefficient of Condell and Spearman between these two variables were - 0.149 and -0.187 respectively and their significance were 0.039 and 0.048 respectively, therefore, the zero-hypothesis based on a lack of relationship between these two variables is being rejected (in the level of 0.05). It can be concluded by increasing the psychology of engineering in the insurance companies, the job stress of employees decreases (negative correlation coefficient).

Job stress						
Spearman			Condell			Job Environment Ergonomics
Frequency	significance	correlation coefficient	Frequency	significance	correlation coefficient	
113	0.048	-0.187	113	0.039	-0.149	

4th Hypothesis

By considering that the Correlation Coefficient of Condell and Spearman between these two variables were - 0.076 and -0.147 respectively and their significance were 0.259 and 0.218 respectively, therefore, the zero-hypothesis based on a lack of relationship between these two variables is not being rejected (in the level of 0.05).

Job stress						
Spearman			Condell			Job Environment Ergonomics
Frequency	significance	correlation coefficient	Frequency	significance	correlation coefficient	
113	0.218	-0.147	113	0.259	-0.076	

DISCUSSION

One of the most important tasks of human force management is to maintain the able employees for creating and providing the competitive advantage in the organizations because in these days, one of the main factors of successful organizations is the able human force and use them. For accomplishing these aims, the employees must access the high level of satisfaction as they increase the value of organizations. One of the main factors is to create job-security satisfaction and one of the basic principles in order to create the job security is the existence of safety and health in the job-environment (Vahabi, Hossein, 2006; 6).

Nowadays, considering the principles of ergonomics in the job-environment, providing the required tools of employees and the standard environment based on the physical and psychic conditions of ergonomics is one of the main points in the organizations. But the other main point in this field is to use these principles by the users (managers and employees) and increase their understanding toward this issue; means that considering these principles not only increases the productivity but also affects their psychic and physical health considerably.

On the other hand, stress is associated with all jobs and all persons means that all individuals face it; based on the recent studies, near 80% deaths are associated with stress directly or indirectly.

Based on the above mentioned points, the purpose of this present paper is to study the ergonomics principles in the organizations, their tools, measure the stress of employees and study this question; which branch of ergonomics has a relationship with stress. The results show that ergonomics of job environment and stress are interrelated and

their relationship is inverse means in the environments in which ergonomics principles are being observed, employees' stress decreases.

Based on the descriptive statistics in the private companies of Rafsanjan, the arrangement of ergonomics principles are as these; job physiology, biomechanics, anthropometry and engineering psychology. And from these branches, ergonomics of job physiology (correlation coefficient=-0.252) has a relationship with employees' stress.

Based on the results, the mean of respondents' view toward all ergonomics' indexes of job environment is about 3 (medium/average) and 4 (good). But their view means the mean about ergonomics is about 4 (good) and on the other hand, the mean about job stress of employees is about 3 (medium).

This shows that ergonomics is being observed in the private companies of Rafsanjan and the level of stress among these individuals is medium. Therefore, based on a relationship between ergonomics and stress, it can be concluded that observing the ergonomics in these organizations is one of the reasons for average level of stress among the employees of Rafsanjan.

In the sub-hypothesis, there is a relationship between job physiology and engineering psychology but the results about job biomechanics and anthropometry indicates the independency of these two indexes to stress. Now, it is better to analyze the obtained results of this study with the other papers in this field.

The statistical calculations show that there is a negative relationship between job physiology and employees' stress. Robins believes that stress can cause disorder in metabolism, increase heart rate, blood pressure, headache and exposes the person to the heart attack (*Robins (translation), 2006; 426*).

On the other hand, *Haghighy et al.*, believe that high volume of job and physical disability result stress (*Haghighy et al., 2004; 395*).

In the present study, by considering the resulted information, it can be concluded that by increasing the job physiology in the private companies, job stress of employees decreases (negative correlation coefficient). It can be said that the metabolism and amount of consumed energy in the person in order to do job is effective in creating stress. And if we consider the required principles as accessibility of tools, appropriateness/suitability of body position, fingers, head, body and type of essential activities in order to do our job in the job-environment, the stress of employees decreases.

Environmental conditions play an important role in doing works. A same work in two different conditions can cause different results. Generally, the suitable environmental conditions in order to do works and appropriate to the type of work accelerates the speed of doing works. The most general types of environmental conditions are light, space, noise and etc although for some jobs, special environmental conditions are needed.

Various studies related to the organizational and industrial psychology show that doing works in the environments with suitable light, appropriate air conditioning and enough space has a positive effect on the way of workers in order to do their works. the existence of harmful rays and chemical substances, warm and cold weather, more noise, crowd, lack of space for especial works, safety problems and insufficient lights such as organizational factors cause stress (*Haghighy et al., 2004; 386*).

Based on the obtained results in this study, it can be concluded that by increasing engineering psychology in the private companies, job stress of employees decreases (negative correlation coefficient). Therefore, we can said that by providing the conditions of engineering psychology and using color, lights, warming and cooling system, noise, air conditioning/ventilation, using the needed time in order to do works and also arranging the objects as good decorations and other ways are effective in decreasing stress.

But the statistical results indicate a lack of relationship between job biomechanics and anthropometry with job stress of employees. The type of governed culture on the employees and being content or satisfy with the present conditions even in the hard conditions, due to the fear of losing job, as the employees believe that stress is the reason of their weakness and try to devalue that work, most of the employees are not as a statistical sample of formal employment, and they try to show that they are able to do their works and activities.

In addition to the work of author in highlighting this issue as the resulted information has a research aspect merely and they do not affect the work and job position of persons, so there is a possibility that these persons avoided to state a reality / fact and also the other reasons such as this one indicate this issue means lack of relationship.

Suggestions

Based on the data analysis and obtained results about these variables, the following suggestions are being presented:

- As the individuals do not pay attention to their health, they try to do their work with high speed and due to the lack of knowledge in some managers, it is better to provide a job environment based on the ergonomics principles, train managers and employees in order to use the tools for increasing the speed of their work and do not harm their health.
- By considering that the job physiology is in relation with job stress more than the other factors, therefore the organizations must consider them and the required trainings must be accomplish in this field in order to decreases the stress of employees.

- Since most of the ergonomics principles are related to the individuals and by passing the rules and regulations, we cannot force the individuals to observe them, therefore, it is being suggested that the managers must use methods or ways as the employees understand its importance for their health and decrease their stress. Using brochures, films and the other tools in order to show the diseases which are being resulted from non-observance of these principles and its affect on stress and performance decreases can be effective.
- By considering that employees of private companies spend most of their time behind the desks and computers, so it is being suggested they should assign some of their time to sport. So, observing the principles of how to use computers, its components such as keyboard, mouse and etc seems essential.
- By considering that observing the engineering psychology principles decreases stress, it is being suggested that managers must consider the main points in designing a job environment such as color, light, noise, warm and cold weather, etc and observe them in the job environment.

Since the employees consider how to do their jobs, finish them and their results, and try to hide their stress, therefore, observing the ergonomics principles by employees is necessary.

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