

ERGONOMIC ASSESSMENT OF COMPUTER WORKSTATION FOR SOFTWARE COMPANY EMPLOYEES IN THAILAND

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Abstract

The purpose of research on Ergonomic Assessment of Computer Workstation for Software Company Employees in Thailand is to explore the working environment of computer workstation toward the impact on the health of the worker. The population used was employees working in Software Company in Thailand which use computer workstation regularly. It is hypothesized that the characteristics of working environment and human posture while working is related to the health of the worker. A questionnaire was completed by 400 respondents and the data was analyzed utilizing descriptive statistics, Independent t-test, One-way ANOVA, and Chi-Square. The results indicated that syndrome in patients with bone and muscle is associated with the placement of the pointing device and the position of leg while working. Patient syndrome with tendon correlated with the keyboard layout and the working position of shoulder, hands, legs and feet. Eye Syndrome is not associated with both the environment and posture while working and other syndromes related to stress and fatigue are correlated with working posture of the head, neck and shoulders.

Keywords: Ergonomic, Computer Workstation, health problem, ergonomic injury-related

1. Introduction

The ergonomic hazards exist at computer workstation due to the poor working environments. Ergonomics at a computer workstation concerns with the appropriate components for a proper working posture that allows employee to feel physically comfortable to prevent the pain from several part of the body. Among those illnesses the Musculoskeletal Disorder (MSDs) is the most serious illness directly related to poorly designed workstations. MSDs are the repeated trauma and deteriorating of the tissues, joint, tendons, and nerves that affect the muscles and supporting structures of the body.(Xue and others-2013) The body parts affected are the arms, hands, fingers, neck, back, wrists, legs, and shoulders; and early warning signs include muscle cramping, stiffness, aching, pain, and weakness in an area. The ergonomics is a Public Health concern, so the aim of this research is to evaluate the ergonomics conditions in the computer workstations of software company employee in Thailand. This research was conducted as a field study to evaluate the ergonomic hazards that employees are exposed to in their computer workstation. Also, the research was designed to promote ergonomics knowledge and to evaluate the association between the design of computer workstations and any pains or discomforts they may experience. The research goal was to see if the occupational health is realized in Software Company in Thailand and to raise ergonomics awareness among the employee in computer-related field.

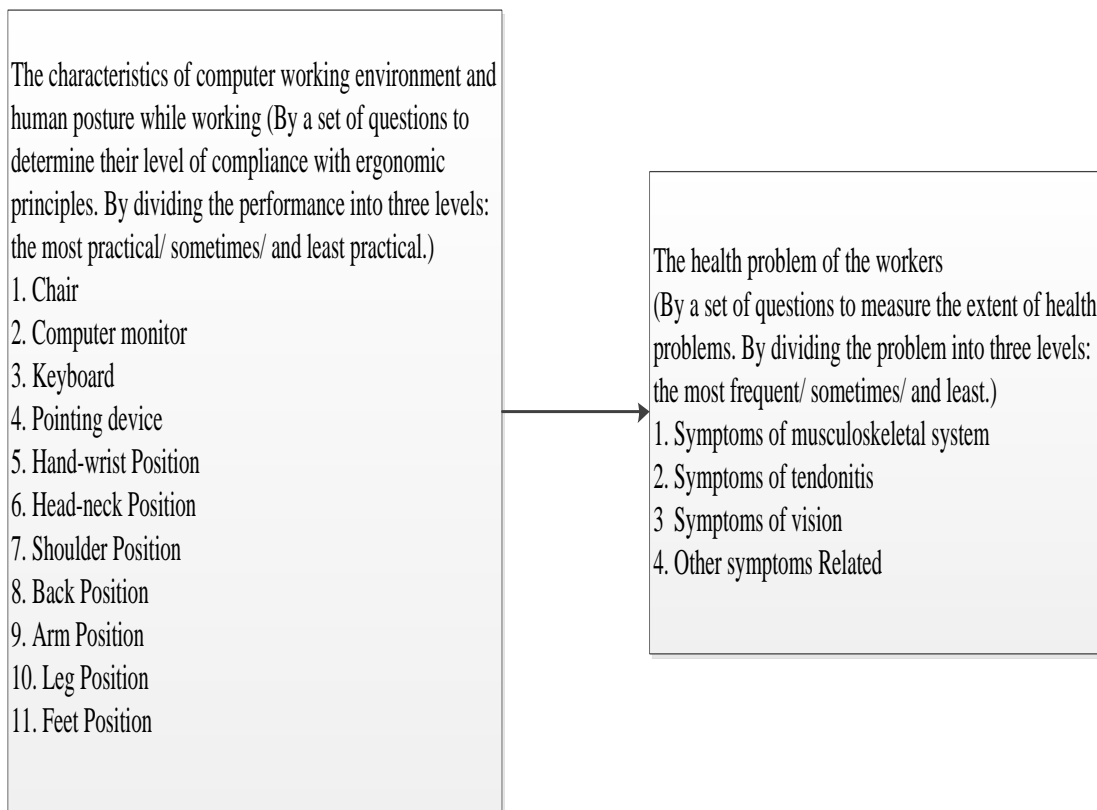
1.1 Objective of the Study

1. To assess the environment of computer workstation for the impact on the health of the employee.
2. To find the relationship between the design of work stations and health problem of the employee.

1.2 Benefit of the Study

Employees and enterprises have been aware of the principles of the ergonomic system for the computer workstation, which can affect the health of the employees.

1.3 Conceptual Framework



Hypothesis

The characteristics of working environment and human posture while working is related to the health of the worker.

2. Data Analysis

2.1 Data Analysis in the category of the nature of computer working environment

Results from the analysis of the computer room environment and human posture while working by frequency, mean and standard deviation are as the followings.

Table 1. Show the Frequency, percentage and standard deviation of computer working environment by placing computer equipment and office equipment

Placing computer equ and office equipment	Level of Practice			\bar{x}	S.D.	Result	Order
	Most Pract	Sometimes	Least Pra				
1. Chair	109 (27.2)	271 (67.8)	20 (5.0)	2.22	0.523	Sometimes	1
2. Computer Mon	110 (27.5)	246 (61.5)	44 (11.0)	2.16	0.599	Sometimes	2
3. Keyboard	105 (26.2)	210 (52.5)	85 (21.2)	2.05	0.688	Sometimes	3
4. Pointing Device	141 (35.2)	208 (52.0)	51 (12.8)	2.22	0.656	Sometimes	1
Total				2.16		Sometimes	

From Table 1, the overall level of practice in placing computer equipment and office equipment according to ergonomics principle is at “Sometimes” level. All equipment are at the same level while chair and pointing device have the highest mean at 2.22 with the lowest mean at 2.05 for placing the keyboard.

Table 2. Show the Frequency, percentage and standard deviation of computer working environment by human posture while working

Human posture while wo	Level of Practice			\bar{x}	S.D.	Result	Order
	Most Pract	Sometimes	Least Pra				
1. Hand-wrist Position	143 (35.8)	207 (51.8)	50 (12.5)	2.23	0.655	Sometimes	1
2. Head-neck Position	87 (17.0)	245 (61.2)	68 (21.8)	2.05	0.621	Sometimes	3
3. Shoulder Position	73 (19.5)	249 (62.2)	78 (18.2)	1.99	0.615	Sometimes	7
4. Back Position	82 (16.5)	252 (63.0)	66 (20.5)	2.04	0.608	Sometimes	4
5. Arm Position	83 (20.8)	247 (61.8)	70 (17.5)	2.03	0.618	Sometimes	5
6. Leg Position	93 (23.2)	220 (55.0)	87 (21.8)	2.02	0.671	Sometimes	6
7. Feet Position	109 (27.2)	209 (52.2)	82 (20.5)	2.07	0.689	Sometimes	2
Total				2.06		Sometimes	

From Table 2, the overall level of practice in human posture while working according to ergonomics principle is at “Sometimes” level. All postures are at the same level while hand-wrist position has the highest mean at 2.23 and the lowest mean at 1.99 for shoulder position.

Table 3. Show the Frequency, percentage and standard deviation about health problem of the workers

Health problem of workers	Level of Health Problem			
	\bar{x}	S.D.	Result	Order
1. Symptoms of musculoskeletal system	1.99	0.497	Sometimes	3
2. Symptoms of tendonitis	1.66	0.521	Least	4
3. Symptoms of vision	2.04	0.512	Sometimes	1
4. Other symptoms related	2.02	0.542	Sometimes	2
Total	1.93		Sometimes	

From Table 3, the overall health problems of the workers that are ergonomic injury-related symptoms are at “Sometimes” level. The highest mean of health problem is 2.04 for symptoms of vision and the lowest mean is at 1.66 for symptoms of tendonitis.

2.2 Data Analysis for Hypothesis Testing

Hypothesis 1: The characteristics of working environment and human posture while working is related to the health of the worker.

Table 4. Shows the correlations between human posture while working (Leg Position) and the health problem of workers (Symptoms of musculoskeletal system)

Computer environment	w	The symptoms of musculoskeletal system			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working							
(Leg Position)							
Least Practical		24	44	19			
Sometimes		53	101	66	14.098	0.133	0.007
Most Practical		33	25	35			

From Table 4 found the relationship between human posture while working (leg position) and the health problem of workers (the symptoms of musculoskeletal system) is at the significance level 0.05 (Sig.= 0.007) and a relationship is at the least level (Cramer's V=0.133).

Table 5. Shows the correlations between human posture while working (hand-wrist position) and the health problem of workers (Symptoms of tendonitis)

Computer environment	w	Symptoms of tendonitis			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working							
(hand-wrist position)							
Least Practical		49	25	11			
Sometimes		116	82	12	9.571	0.109	0.048
Most Practical		47	45	13			

From Table 5 found the relationship between human posture while working (hand-wrist position) and the health problem of workers (the symptoms of tendonitis) is at the significance level 0.05 (Sig.= 0.048) and a relationship is at the least level (Cramer's V=0.109).

Table 6. Shows the correlations between human posture while working (shoulder position) and the health problem of workers (Symptoms of tendonitis)

Computer environment	w	Symptoms of tendonitis			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working (shoulder position)							
Least Practical	57	18	3				
Sometimes	121	107	21	20.502	0.160	0.000	
Most Practical	34	27	12				

From Table 6 found the relationship between human posture while working (shoulder position) and the health problem of workers (the symptoms of tendonitis) is at the significance level 0.05 (Sig.= 0.000) and a relationship is at the least level (Cramer's V=0.160).

Table 7. Shows the correlations between human posture while working (hand position) and the health problem of workers (Symptoms of tendonitis)

Computer environment	w	Symptoms of tendonitis			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working (hand position)							
Least Practical	47	17	6				
Sometimes	127	102	18	11.379	0.119	0.023	
Most Practical	38	33	12				

From Table 6 found the relationship between human posture while working (hand position) and the health problem of workers (the symptoms of tendonitis) is at the significance level 0.05 (Sig.= 0.023) and a relationship is at the least level (Cramer's V=0.119).

Table 8. Shows the correlations between human posture while working (leg position) and the health problem of workers (Symptoms of tendonitis)

Computer environment	w	Symptoms of tendonitis			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working (leg position)							
Least Practical	62	21	4				
Sometimes	107	94	19	17.307	0.147	0.002	

Most Practical	43	37	13
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From Table 8 found the relationship between human posture while working (leg position) and the health problem of workers (the symptoms of tendonitis) is at the significance level 0.05 (Sig.= 0.002) and a relationship is at the least level (Cramer's V=0.147).

Table 9. Shows the correlations between human posture while working (feet position) and the health problem of workers (Symptoms of tendonitis)

Computer environment	w	Symptoms of tendonitis			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working							
(feet position)							
Least Practical	53	22	7				
Sometimes	99	95	15	12.756	0.126	0.013	
Most Practical	60	35	14				

From Table 9 found the relationship between human posture while working (feet position) and the health problem of workers (the symptoms of tendonitis) is at the significance level 0.05 (Sig.= 0.013) and a relationship is at the least level (Cramer's V=0.126).

Table 10. Shows the correlations between human posture while working (head-neck position) and the health problem of workers (Other symptoms related)

Computer environment	w	Other symptoms related			Statistics		
		Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working							
(head-neck position)							
Least Practical	6	44	18				
Sometimes	51	157	37	10.075	0.112	0.039	
Most Practical	13	53	21				

From Table 10 found the relationship between human posture while working (head-neck position) and the health problem of workers (Other symptoms related) is at the significance level 0.05 (Sig.= 0.039) and a relationship is at the least level (Cramer's V=0.112).

Table 11. Shows the correlations between human posture while working (shoulder position) and the health problem of workers (Other symptoms related)

Computer environment	Other symptoms related			Statistics		
	Least	Sometimes	Most frequent	χ^2	Cramer's V	Sig.
Human posture while working						
(shoulder position)						
Least Practical	12	51	15			
Sometimes	42	169	38	13.001	0.127	0.011
Most Practical	16	34	23			

From Table 11 found the relationship between human posture while working (shoulder position) and the health problem of workers (Other symptoms related) is at the significance level 0.05 (Sig.= 0.011) and a relationship is at the least level (Cramer's V=0.127).

Hypothesis 1: The characteristics of working environment and human posture while working is related to the health of the worker.

Computer working environment	The health problem of workers			
	Symptoms of musculoskeletal system	Symptoms of tendonitis	Symptoms of vision	Other symptoms related
Chair	-	-	-	-
Computer Monitor	-	-	-	-
Keyboard	-	✓	-	-
Pointing Device	✓	-	-	-
Hand-wrist position	-	-	-	-
Head-neck Position	-	-	-	✓
Shoulder Position	-	✓	-	✓
Back Position	-	-	-	-
Arm Position	-	✓	-	-
Leg Position	✓	✓	-	-

3. Conclusion, Discussion and Recommendations

3.1 Summary from the findings

Hypothesis 1: The characteristics of working environment and human posture while working is related to the health of the worker. Found that:

- Symptoms of musculoskeletal system are associated with the placement of the device (pointing device) and the human posture while working (leg position).
- Symptoms of tendonitis are associated with the human posture while working especially for hand-wrist, shoulder, arm, leg, and feet position.
- Symptoms of vision are not associated with any of computer working environment for both placement of the device and the human posture while working.
- Other symptoms related to stress and fatigue are associated with the human posture while working for head-neck and shoulder positions.

3.2 Discussion

Part 1. Overview

All of the respondents working in software company, most of them are the new generation with the age under 40 years and less than 3 years of working experience. That period (< 3 years) may not long enough to detect abnormalities in the body which result from the ergonomics problem. The analysis found that the placement of all computer equipment and human posture while working are not compliance with the principle of ergonomics. All three levels of compliance are defined as the most practical, sometimes, and least practical. The results found that all sides were level at “sometimes” meaning that no adjustment is required under the principle itself.

The issues of health problem for the worker, respondents agree that there are problems in various fields. Overall, there were some health problems in several areas with the exception of leg numbness, palm pain, elbow pain, and double vision. Results of the survey show that health problems persist in the workplace. But for those who have the most health problem may not be able to work and does not answer such a query. Data analysis of the survey can be used for the benefit of organized knowledge as well as improvements the workstation in accordance with rules and guidelines on ergonomics. Besides the health issues, this knowledge could also contribute to improving the effectiveness and efficiency of work. This is consistent with the research of Kathryn M. Culig et al, 2008.

Even though most employees have been through the learning and training program of ergonomics in the workplace, however, when used in actual practice, they are neglecting to follow the principle. Hence giving knowledge along with behavior modification and evaluation will continuously contribute to ergonomics deployment more efficient. This is consistent with the findings of Cole et. Al., 2002, and Perdue, 1999 and according to the instructions of Khan R1, Surti A, Rehman R, Ali U., 2012 and Xue. Liu, Rhoda. Kuziez, Kee-Hean. . Ong., 2013

Part 2. Hypothesis Testing

Hypothesis 1: The characteristics of working environment and human posture while working is related to the health of the worker.

Hypothesis testing found that the characteristics of the computer working environment have not much effect on the health problem. However, the employee's posture while working affects many aspects of health issues especially symptoms of tendonitis which is the main health problem of the respondents. Therefore, organizations should focus on measures and approaches to educate employees in ergonomics field to reduce such health issues.

3.3 Recommendation

Findings from the research are suggested with respect to research as the following:

1. Most of the employees still know very little about ergonomics. The organization must inform the employees on the principle of ergonomics and make them realize how wrong operation of ergonomics will result in the field of health problem and other area.
2. The study found that the respondents are not comfortable physically and symptoms of tendonitis are most likely to result in a barrier to performance. Therefore, it should focus on ergonomic principles into practice in the organization which believe to increase working performance.

3.4 Suggestion for further study

The findings can be used to improve the computer working environment in accordance with the rules of ergonomics. In that way, it will also increase the efficiency and effectiveness of working performance. To add value to the research, some suggestion may be introduced as follows:

1. There should be studied with the original sample group about their intention to adjust working environment according to knowledge of ergonomics. Also studied about the health problem in whether it has been declined or not.
2. The strengths of this research is to be completed by the asker who measures the employee arrangement of computer workstation and compare to those of ergonomics principle before recorded them. That will make data more reliable from the real working environment. But the health problem, this research continues to use the method of observation with the naked eye and reference data mostly from the respondents. Sometimes the health data could not reflect the real situation. The suggestion for this problem is if the research asked for feedback from employee on sick leave, reimbursement of medical expenses or from a certain medical record. That would help the research to get data more clearly on the relationship between gesture and ailments performance.
3. Other factors which related to the health problem should be studies beside the arrangement of computer workstation and posture while working. Give example factors such as employee dressing, temperatures, characteristic of task, movement during the working hour. Those extra factors might give some relationship with the health problem as well.

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