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Determinants of computer use: Insights from standard measurements and personal user parameters

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Abstract

In today's world majority of the people are using computer and it has made our life very much easier. The present study is conducted in Dr. Rajendra Prasad Central Agricultural University, Kendriya Vidyalaya, Uma Pandey College and Block Office of Pusa Block, Samastipur, Bihar as there were a lot of active computer users. It is estimated that at least 75 per cent of the works are done through the use of computer, but the people are unaware about the health consequences of the computer use. Health problems of the computer users are mainly associated with the duration of computer use, improper computer workplace and the various environmental factors like positioning of computer screen, keyboard and mouse. Results from the study showed that half of the respondents were male and another half were female, among them majority of the users (48.33%) belonged to age group 20-30 years and (43.33%) belonged to age group 30-40 years. Majority of the computer users were working at average level of nature of work and 23.33 per cent of them had worked in poor level. Variables like age, income, gender, education and work environment of the computer users were found to have significant relation with the difficulty in eyes of the respondents and work environment of the users was inversely proportional to the difficulty experiences by the user in eyes. It was concluded that the work of the computer users was sedentary type which gradually develops chronic illness because of the bad postures adopted by the computer users, while performing their work for a prolonged time on a regular basis.

Keywords: Computer users, health problems, work environment, gender, education

Introduction

In the present scenario, the technology is well developed and has made our life so advantageous that it is very difficult to imagine our life without computer, internet, mobile phones and electronic gadgets. Some years back increasing number of people were using computers for their official and personal use. In nineties people were mainly using computer to do their office work but now a day's computer is being used to do lot of tasks like reading, writing, typing and different types of animation, data entry, networking, watching movies and gaming etc.

Excluding the physical factors of user, environmental factors like temperature, light intensity, humidity also affect the works of the users (Gupta 2012) ^[1]. According to Occupational Safety and Health Administration (OSHA, 2004) work furniture and related equipment such as desk, chair and work surface can be uncomfortable to the user which may result to awkward position.

According to National Institute for Occupational Safety and Health (NIOSH, 1990) ^[9] more than 75 per cent of users have discomfort in their back, neck and shoulder. Further, it was noticed that 20-25% of computer users experience

upper back pain. Shoulder pain, neck pain, backache, pain in legs and arms and even swelling in joints and muscles are the frequent disorders among computer users. Job stress and demand of computer user lead to risky physical and cognitive work-related processes, which may be due to adoption of awkward posture and lack of break in working hours. Muscle fatigue is the important factor which results in musculoskeletal disorder (MSD). The present study is aimed to learn about the impact of work environment on the worker's health.

Computer Workplace

Considering the long working hours and demand of computer users, the design and nature of computer work station should be proper to ensure the comfort, safety and the total well-being of the users. From an ergonomic perspective, work station design enhances the productivity and minimizes the stress effectively through interaction between various components of computers. Computer workplace is the place, where work of a particular nature is carried out. According to International Organization for Standardization (ISO) parameters such as sitting postures,

monitor position, requirement of seating, arm rest, back rest, leg space and workspace are the suggested standards, which guide to design a computer work station. Even well designed Visual Display Terminal (VDT), keyboard and mouse are important to set up and use equipment properly.

The work related problems of all the users can be resolved by providing an appropriate work environment. Design of work station should provide flexible workplace which enables to create their own comfortable environment. Computer users have shown an increased output from 20-25 per cent because of ergonomically improvement in the layout of work station. In a computer work station correct working environments are related to ensure the compliance with the recommended four aspects. It is essential to ensure:

- Proper work environment
- Proper organization of computer workplace
- Proper posture during work performance
- Proper work environment of human work

Lack of knowledge or inappropriate application of ergonomic principles is the main problems of an improper workstation design. Improper workstation design significantly affects the working postures which contribute to physical symptoms by Visual Display Unit (VDU) operators. Musculoskeletal disorders and visual discomfort may result due to improper work station. United States Bureau of Labour Statistics has defined that the fastest growing category of work-related illnesses and user compensation claims as well as absenteeism are drastically growing due to ergonomic workstation deficiency hazards.

Methodology

Field survey was carried out in selected employees of Dr. Rajendra Prasad Central Agricultural University Pusa, Bihar. A pre- structured interview schedule was developed to collect information and self- observation technique was also followed to assess information related to the condition of work environment. Field survey was accomplished by following step by step procedure. For the field survey, a sample of 60 respondents from Dr. RPCAU, Pusa block, school and Uma Pandey college of Pusa, Samastipur who have been working with computer for 4-6 hours daily were selected. Pre structured interview schedule containing both background and specific information was developed. Various professional course, duration of computer use, breaks, different posture acquired by the users, while performing the work and problems confronted by the users. It also included the information regarding work environment of the users. Interview schedule content comprised of their Socio-economic profile, work- profile, musculoskeletal problems, anthropometric measurements, various environmental parameters, health profile, weight, height, BMI.

Results and Discussion

socio-Economic Profile of Computer users

The Socio-personal and economic profile of selected respondents are discussed in this section. It's important to be familiar with the respondents' socio- economic profile so that the study's findings can be interpreted correctly and an effective conclusion can be drawn. Sex, age, category, education, occupation, family size, and income were all part

of the socioeconomic profile of respondents.

Gender

It is obvious from the mentioned Table1 that half of the computer users were male and half were found to be female. In this scenario, the study's results are attributed to the fact that fifty percent of the samples were taken on purpose for both male and female subjects. This finding is quite similar to (Moom, 2015) ^[8] who conducted his study between male (60%) respondents and female (40%) respondents.

Age

The data in Table1 shows that the majority of computer users (48.33%) were in the age group (20-30 years), followed by 43.33 percent in the age group (30-40 years), and 8.34 percent in each of the age group (40-50 years) and (50 years and above). According to this report, the majority of computer users fall under the ages of 20-30 years. The results were in consonance with (Gupta, 2012) ^[1] noted that 41 per cent of the computer users belonged to the age group 31-35 years, 28 per cent belonged to the age group 36-40 years and 26 per cent of the computer users came under the age group of 26-30 years.

Education

In terms of respondent educational levels, Table 1 indicates that three- quarters (75.00%) of the respondents were postgraduates, followed by graduate (23.33%) and intermediate respondents (1.67%). The results were contradictory to the study of (Kaur, 2014) ^[3] who divulged that more than half of the respondents were post graduate followed by graduate and intermediate.

Occupation

Skilled and official staffs are the words used to describe the professions of respondents. Analysis of data revealed that half of the respondents were professional employees and another half of them were government employees.

Table 1: Distribution of Computer Users as per the socio-economic characteristics N=60

S. No.	Gender	Particulars	Frequency	Percentage
i.		Male	30	50.00
ii.		Female	30	50.00
Age				
i.		Below20years	-	-
ii.		20-30years	29	48.33
iii.		30-40years	26	43.33
iv.		50yearsandabove	5	8.34
Education				
UptoMatriculation			-	-
UptoIntermediate			1	1.67
UptoGraduation			14	23.33
PostGraduationandabove			45	75.00
Occupation				
Professional			30	50.00
Official			30	50.00

Evaluation of computer table of the respondents

Musculoskeletal problems and physical stress of computer

users can be maintained by the appropriate dimensions of the working table, which play a great role to reduce the computer related health impacts. Too low or too high work surface can lead to fatigue particularly in users arms and shoulder muscles (Canadian Standards Association guideline, 2004). That is why the table used by the respondents were evaluated and compared with the standard values. The standard values of computer desk are given below-

Table 2: Standard Measurements of different dimension of table

S. No	Dimension	Measurements (In inches)
1.	Table height	30-32inch
2.	Table width	24-36inch
3.	Table thickness	1-2inch

Source: Canadian Standards Association (CSA) guideline 2006

Height of the Table

The results mentioned in Table 3 showed that 90 per cent of the computer users were using the table height ranging from 20-30 inches, whereas 5 per cent of the respondents were using the table height either in the range between 30-40 inches or above 40 inches.

Length of the Table

Among all the respondents 48.33 per cent of respondents were working with a table with a varied length from 20-30 inches followed by 31.67 per cent computer users, whose table length was noted to be above 40 inch and 20 per cent of the computer users had table length of 30-40 inches.

Breadth of the Table

Analysis of data noted that majority of the respondents (88.33%) had their table width of 20-30 inches, whereas 6.67 per cent of the respondents had table breadth below 20 inches and only 5 per cent of the respondents had table breadth 30-40 inches.

Thickness of the Table

It was expressed that more than half of the computer users (55%) had their table thickness of 1 inch, which is considered as standard, while 31.67 per cent respondents had 0.5 inch thickness of computer table. It is also noted that 11.67 per cent of respondents had table thickness of 1.5 inch and only 1.67 per cent respondents had table thickness of 2 inches.

Distance of Table from the computer users

From the data analysis, it was observed that majority of respondents (65%) placed their monitor at a distance of 20-30 inches followed by 33.33 per cent respondents having distance of 30-40 inches and only 1.67 per cent of respondents maintained the distance of below 20 inches because of heavy workload in the monitor.

The findings were quite similar with the study of (Kaur, 2014) [3], who evaluated that 61.66 per cent of the respondents were using a desk of width 122-147cm, whereas 33.33 per cent of respondents had desk depth of 41.75- 48.25 cm. It is also found that 10 per cent of the respondents were using a desk height of 69-72 cm.

Table 3: Distribution of computer users according to the different dimensions of their table N=60

Sl. No	Dimension	Frequency	Percentage
Height (Inch)			
i.	Below 20	-	-
ii.	20-30	54	90.00
iii.	30-40	3	5.00
iv.	40 and above	3	5.00
Length (inch)			
i.	Below 20	-	-
ii.	20-30	29	48.33
iii.	30-40	12	20.00
iv.	40 and above	19	31.67
Breadth (inch)			
i.	Below 20	4	6.67
ii.	20-30	53	88.33
iii.	30-40	3	5.00
iv.	40 and above	-	-
Distance from computer to user			
i.	Below 20	1	1.67
ii.	20-30	39	65.00
iii.	30-40	20	33.33
iv.	40 and above	-	-
Thickness (inch)			
i.	0.5	19	31.67
ii.	1	33	55.00
iii.	1.5	7	11.67
iv.	2	1	1.67

Evaluation of Environmental Parameters of Computer Users

Environmental parameters of computer users include temperature, noise, light intensity and relative humidity. At the computer workplace comfortable environmental parameters help the users to work with computer very efficiently, which lead to increase in the output (Gupta 2012) [1]. Soevaluation of environmental parameters of computer workstation was noticed and compared with the standard value of the environmental parameters. As to Occupational Safety and Health Administration (OSHA) the standard environmental parameters are such as-

Table 4: Standard Measurements of different dimensions of the chair

S. No.	Dimension	Measurements (In inches)
1.	Height	28-30inches
2.	Sitting height	16-21inches
3.	Width	17-20inches
4.	Height of backrest	12-19inches

Source: Canadian Standards Association (CSA) guideline 2006

Height of chair:

Data pertaining to the different dimensions of computer user's chair, revealed that 88.33 per cent of the respondents had their computer chair's height of 30-40 inches, which was higher than the standard height, whereas this was followed by the respondents (6.67%) were using chair height, which was below 20inch height and only 5 per cent respondents had their chair's height above 40 inches.

Sitting Height of Chair

Data was calculated, it was indicated that a maximum number of respondents (78.33%) had their chair's sitting

height of 15-20 inches, while 11.67 per cent respondents had 20-25 inches of their chair's sitting height followed by each 5 per cent of respondents' chair's height found to be below 15 inch and another one was above 25 inches.

Width of the Chair

From the Table-5 it was noted that the computer user's chair width of 15-20 inches and was used by 76.66 per cent of the computer users, whereas each of 11.67 per cent of respondents were using chairs with width of 10-15 inches and 20-25 inches.

Height of the Back Rest

The height of back rest is an important part of the chair, which provides supports to the spinal cord of the computer user and prevents them from neck pain. Respondents (63.33%) were having height of back rest of 15-20 inches followed by 21.67 per cent respondents, who were having their chair's height of back rest of 10-15 inches and few respondents (8.33%) had used their chair's back rest height of above 20 inches and 6.67 per cent respondents had their chair's back rest height below 10 inches.

The above results were in consonance with the findings of (Kaur, 2014) [3], who revealed that 70 per cent of the computer users were using a chair of height (22- 30cm). Further, it was recorded that 66.66 per cent and 58.33 per cent respondents were using a chair of seat depth (48.26-54.74 cm) and seat width (47.65-59.35cm) respectively. Whereas, all the respondents were having a chair of back rest height of 48.20 - 63.80cm. 33.33 per cent respondents had a back rest width of chair (32-36 cm).

Table 5: Distribution of computer users according to the different dimensions of their chair N=60

Dimensions	Frequency	Percentage
Height (In Inches)		
Below 20	4	6.67
20-30	-	-
30-40	53	88.33
40 and above	3	5.00
Sitting Height (In Inches)		
Below 15	3	5.00
15-20	47	78.33
20-25	7	11.67
25 and above	3	5.00
Width (In Inches)		
10-15	7	11.67
15-20	46	76.66
20- 25	7	11.67
25 and above	-	-
Height of Back Rest (HBR) (Inches)		
Below 10	4	6.67
10-15	13	21.67
15-20	38	63.33
20 and above	5	8.33

Evaluation of Environmental Parameters of Computer Users

Environmental parameters of computer users include temperature, noise, light intensity and relative humidity. At the computer workplace comfortable environmental parameters help the users to work with computer very efficiently, which lead to increase in the output (Gupta

2012) [1]. So evaluation of environmental parameters of computer workstation was noticed and compared with the standard value of the environmental parameters. As to Occupational Safety and Health Administration (OSHA) the standard environmental parameters are such as-

Table 6: Standard Measurements of different Environmental Parameters

S. No	Environmental Parameters	Measurements
1.	Temperature	20-25 °C
2.	Noise	50-65dB
3.	Light intensity	500-700Lux
4.	Relative humidity	40-50%

Source: Occupational Safety and Health Administration (OSHA)

Season of computer usage

Season is one of the important environmental parameters, which affect the work efficiency of a computer user and its output as different people reported different seasons for performing more efficient work. From the survey it is observed that as Pusa Block of Samastipur District, Bihar is surrounded by river Budhi Gandak from three sides, people who are residing here feel extreme cold during winter and extreme hot during summer. Due to these reasons, majority of the respondents (83.33%) preferred to work in summer season due to the conducive environment while typing works, while 13.33 per cent of computer users who practiced to work in winter season reported that their different body parts of computer users got stiffed due to extreme cold and did not work properly. Further, it was indicated that only 3.34 per cent of respondents preferred to work in rainy season.

Temperature

From this experiment, it was observed that the temperature is vital environmental parameters as it is difficult to maintain the consistent temperature in the workstation. Table-4.9 revealed that more than half of the computer users (53.33%) were working under the temperature ranging from 200 C-250C, which was noted as the same to below the standard temperature i.e. 200C - 250C, whereas 26.67 per cent of respondents were working at temperature ranging between 300 C- 350 C, which was quite higher than the normal temperature. Only 20 per cent of the computer users were working at a temperature of below 200C, which was much lower than the normal temperature and created unfavorable environment to the users and distracted them from their work.

Noise

The noise creating unit in the computer workstation are air conditioner, Visual Display Terminal (VDT), printers and operators, which normally creates fatigue and stress level in the working environment (Shobha, 2011) [11]. So far as the noise level is concerned, it was observed that a large number of the respondents (93.33%) had been working under the noise level of 50-65 dB, which is as per the standard level of measurements, which highlighted that University office building had maintained computer room's facilities and only 6.67 per cent of the respondents had worked at place with noise level of 80-95dB, which was much higher than the normal noise level, which resulted in the disturbance of the

workers in their work mainly occurred in the Blocks as there was lot of persons came with their works. Equivalent results were obtained by Lin (2014) ^[7], who found that noise had a significant effect on reading paragraphs, which was better at 30 dB than 60 dB and 90 dB.

Light Intensity

Improper lighting in the computer workstation creates visual fatigue to the workers. From this study, it was documented that only 6.67 percent of the respondents had workstation having the standard light intensity that ranged from 500-700 Lux. Half of the respondents (50%) were working in a computer workplace, where the light intensity varied from 234.5 - 445 Lux followed by 43.33 per cent of respondents worked under lesser light intensity place (below 234.5 Lux). Results of the present study were in consonance with the study of Kumari and Kaur (2018) ^[6], who observed that medium, small and microcomputer enterprises were having light intensity of 295.5 Lux, 164 Lux and 117.60 Lux respectively.

Relative Humidity

Analysis of the data, it was expressed by the respondents (40%) had worked under normal relative humidity (40-50%) of the computer workplace, whereas 23.33 percent of the respondents were working at (50-60%) of humidity. It was also noticed that 20 per cent and 16.67 per cent of the computer users were working in workplace, where the relative humidity was measured above 70 per cent and 60-70 per cent respectively. The findings were similar Kumari and Kaur (2018) ^[6], who revealed that the medium scale computer enterprise (78.25%) and micro scale computer enterprise (67.80%), were having highest relative humidity.

Table 7: Distribution of Computer Users on the preference of the different environmental parameters N=60

Frequency	Percentage
50	83.33
8	13.33
2	3.34
12	20.00
32	53.33
-	-
16	26.67
-	-
24	40.00
14	23.33
10	16.67
12	20.00
26	43.33
30	50.00
4	6.67
-	-
56	93.33
-	-
4	6.67

Table 8: Ergonomic Evaluation of Nature of Work of Computer Users

Category	F	%
Good (>103.38)	2	3.33
Average (94.81-103.38)	44	73.33
Poor (<94.81)	14	23.33

Mean±SD103.38±94.81

The Table 8 indicates that a majority of the selected computer users (73.33%) were working at the average level of nature of work at the computer workplace. A sizable percentage of respondents (23.33%) had worked at poor level of nature of work in the workplace and only 3.33 percent computer workers were usually working at good nature of work at the workplace. These findings are quite familiar with the study of Reema (2018) ^[10], who found that more than 70 per cent of respondents had stable working surface. It was also observed that 46.5 per cent of the computer users performed incorrect work surface and 45 percent of the computer users had correct work height. It was also observed that 86.25 per cent of the respondents had located their keyboard in front of the computer. The results were also supported by the findings of Kumar *et al.* (2018) ^[5], who identified that the table height and the seat height were too high for the students, which resulted in pain and musculoskeletal problems. Hussain *et al.* (2015), who divulged that 66 per cent of the students were habituated to maintain bad posture while sitting and it was inadequate to use back support of the chair. Reema (2018) ^[10] revealed in her study that 83.75 percent of the respondents directly placed their monitor in front of them. Moreover, it is also reported that more than half of the respondents placed their monitor angle backward to them.

Conclusion

Poorly designed computer workplace is also another main cause to develop musculoskeletal disorders. Computer workplace mainly includes different dimensions of the computer and environmental parameters that affects the productivity of the computer. Placing of monitor too high or too low forced the body of the users to tilt their neck and head which leads to musculoskeletal disorders. Proper placement of keyboard and mouse also play an important role to reduce the musculoskeletal disorders. Workplace furniture like desk, chair monitor also helps to reduce the musculoskeletal disorders. Too high or too low desk and chair of the computer users results in the pain in neck, upper back, shoulders, hands and arms.

It is observed that work environment and proper ergonomic design play a major role to enhance the productivity of the users. Adequate desk height, proper seating and proper distance of computer from their user's eye with environmental factors like proper lighting, temperature and noise level are the different elements of ergonomically designed computer workplace (Kumah *et al.* 2016) ^[4]. The computer workstation consists of the computer accessories like furniture of the computer workplace, desk, chair, monitor, keyboard, mouse and environmental parameters like temperature, humidity, noise, lighting and glare are the ergonomic factors, which lead to vision problems and musculoskeletal disorders, if these factors are improperly designed.

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