To examine the effect of computer accessories in relation to perceived exertion of users

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***Abstract*: Physical fatigue can be estimated by perceived exertion a person experiences during physical activity, including increased heart rate, increased respiration or breathing rate, increased sweating, and muscle fatigue. Although this is a subjective measure, a person's exertion rating may provide a fairly good estimate of the actual heart rate during physical activity. Thus, the present study was planned with the following objectives (a) to study the physical features and pattern of computer use by the selected respondents and (b) to examine the exertion perceived by the women respondents while working on computer consoles. Random sampling technique was used to select a total sample of sixty female computer users from all constituent College of the Agricultural University. A sample of sixty female respondents was selected who worked on computer daily (minimum 2 hours). A pre-tested interview schedule was formulated to gather information regarding use of computer accessories and its effects on rated perceived exertion. In this physiological assessment of respondents is done with and without use of accessories while working on computer consoles and related perceived exertion is determine by using Varghese RPE (Rated Perceived Exertion) . Significant difference is found in rated perceived exertion while working on workstation with computer accessories. Working on computer console with accessories is found to be more comfortable to do computer work.**

***Keywords*: exertion, computer, work, accessories, women.**

Introduction

Intensive computer work puts stress and strain on muscles, as well as on joints, because of continuous and repetitive nature of movements. According to Karakolis & Callaghan (2014) discomfort is seen as an unpleasant state of the human body in reaction to its physical environment.

The duration of work time one spends on computer is also rising (Bhanderi *et al.* 2008). Prolonged working on computer, higher level of concentration involved in computer work can lead to physical and mental stress to computer users.

. In recent years investigations of work related musculoskeletal disorders has attracted considerable attention because of its importance in assessing ergonomics risk factor involved in industrial workplaces. Occupational risk factors such as force, posture, movement, and vibration can affect the musculoskeletal system (Kilbom,1994). Computer console design from an ergonomics perspective can effectively enhance productivity and minimize stress through the interaction between the various system components (Dempsey *et al.* 2004).

Sharma (2006) has stated that women computer operators have more musculoskeletal complaints since, computerized jobs are more sedentary and require more cognitive processing and mental attention and therefore the use of computers have been found to be stressful (Carayon, 1993).

An optimum workstation design with other necessaries computer accessories that can keep the operator comfortable must provide adequate postural support, proper distribution of body/limb weight, natural body/limb positions and should require little demand to use maximum reach or force. Mostly computer users are ignorant about the long term health hazards due to working on computer consoles. Hence the present study has been formulated with the following objectives:

Objectives

1) To study the working pattern and usage of computer by women computer users .
2) To study the exertion perceived by women computer users.

Material and method

This study was conducted in Himachal Pradesh Agricultural University, Palampur purposively because of existence of four computer laboratories (one in each college).The interview schedule was prepared in accordance with the objectives of the study to collect data from the selected respondents. After the schedule was finalized, the total sample of 60 female computer users for the survey within the age range of 21-35 years who generally used to work on computer for at least 2 hours daily were selected.

The laboratory experiments were conducted in the Department of Family Resource Management CSKHPKV, Palampur. In order to conduct laboratory experiments a modified computer console was designed keeping in consideration popliteal height sitting (45 cm) and sitting elbow rest height (65 cm) of the respondents.

Based on the survey results of 10 volunteer female respondents were selected for laboratory experiments having all the physiological parameters in close proximity to know the change in physiological parameters while working on existing and modified computer consoles.

Results

1 Background profile of female computer users

Background information of female computer users comprised of their age, weight, height, educational level and experience of working on computer.

2 Age

The age of the respondents ranged between 21 to 35 years. Table 1 showed that out of 60 respondents majority of them, that is, 75 per cent belonged to the age group of 21 - 25 years, 15 per cent respondents were in the age group of 26-30 years, whereas only 10 per cent fell in the category of 31-35 years of age.

3 Weight

The weight of respondents ranged between 47 to 71 kg. The perusal of the Table 1 indicated that 86.67 per cent of the respondents were in the weight category up to 47 - 55 kg followed by 10 per cent of the respondents in the weight category of56 - 63 kg.

Table 1 Distribution of respondents according to their personal characteristics

N=60

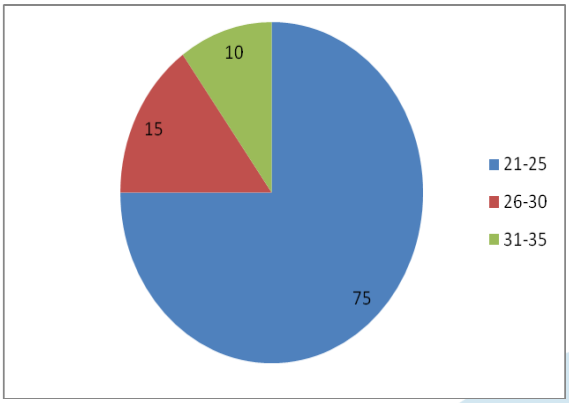
Sr. No.	*Background profile*	*Category*	*No. of respondents*
1	Age (years)	21-25	45(75.00)
		26-30	9(15.00)
		31-35	6(10.00)
2	Weight (Kgs)	47-55	52(86.67)
		56-63	6(10.00)
		64-71	2(3.33)
3	Height (centimetres)	145 to 155	43(71.67)
		156 to 165	13(21.66)
		more than 166	4(6.67)
4	Education level	Post graduation	49(81.67)
		Doctor of Philosophy	11(18.33)
5	Experience of working on computer(years)	2 to4	44(73.33)
		5 to 8	14(23.34)
		9 to 12	2(3.33)

Note: Figures in parenthesis indicate percentages of respondents

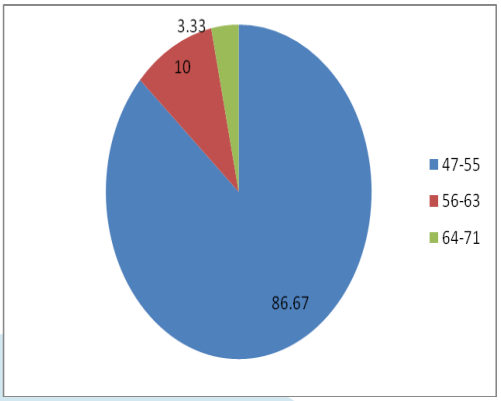
4 Height

The height of selected respondents range is between 145 to 165 cm and above. It has been observed that majority of respondents, that is, 71.67 per cent were having height in the range between 145-155 cm followed by 21.66 per cent who were having height range between 156 – 165 cm and a minimum number of respondents that is 6.67 per cent were having height more than 166cm.

Fig. 4.1

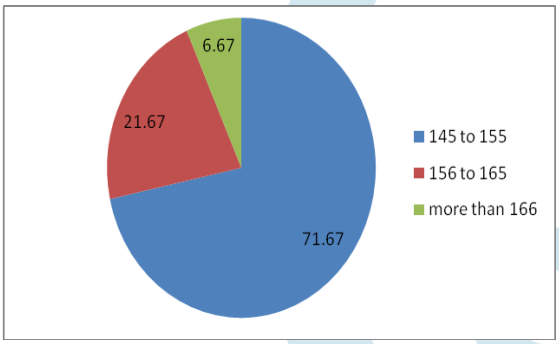


Age

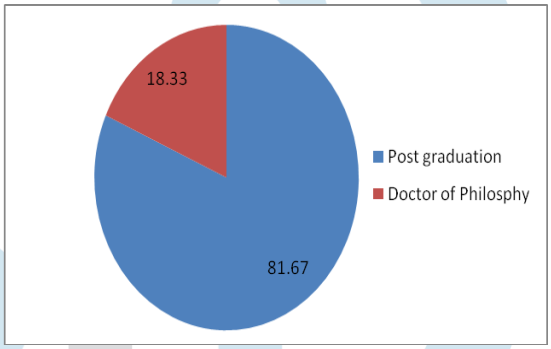


Weight

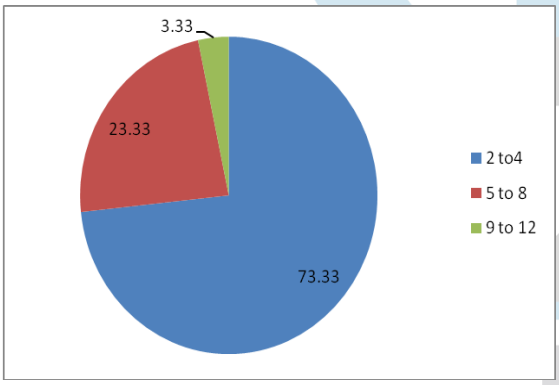
Fig. 4.1 Distribution of respondents according to personal characteristics



Height



Education level



Experience of working on computer

5 Educational level

Data enfolded in Table 1indicated that majority of the respondents were doing their post-graduation that is 81.67 per cent followed by 18.33 per cent who were doing Doctor of Philosophy respectively.

6 Experience of working on computer

The average number of years of experience while working on computers by the respondents may help in determining the speed / efficiency of the respondents. It was clear from Table 1 that majority of the respondents, that is, 73.33 per cent had 2 to 4 years of experience, followed by 23.34 per cent who had 5 - 8 years of experience whereas, only 3.33 had 9 to 12 years experience of working on computer.

7 Pattern of computer usage

The pattern of computer usage by female computer users has been explained keeping in view the total number of hours of computer use, frequency as well as purpose of computer usage.

8 Hours spent on computer

It is seen from the Table 2 that majority of respondent that is 63.33 per cent respondents were using computer between 2 - 4 hours per day(3.58 mean score), followed by less than two hours(3.01 mean score) and least used computer for more than 4 hour per day(2.57 mean score).

9 Purpose of computer usage

As far as purpose of computer usage is concerned it is seen from Table 2 that computer was used for multiple purposes by the respondents. Majority of the respondents were using computer for education purpose that is 70.00 per cent followed by 68.33 per cent for chatting, 41.67 per cent for research and least 16.67 per cent used it for playing games.

Table 2 Distribution of respondents according their pattern of computer us N=60

Note: Figures in parentheses indicate percentages of respondents

Pattern of computer use		*More frequently*	*Frequently*	*Less frequently*	*Not at all*	*Total*	*Mean score*
sing of hours							
Number of hours of work per day	Less than 2	5(8.34)	18(30.00)	37(61.77)	-	60(100)	3.01
	2 to 4	12(20.00)	38(63.33)	10(16.67)	-	60(100)	3.58
	More than 4	8(13.33)	23(38.33)	29(48.84)	-	60(100)	2.57
urpose of usage							
For education		42(70.00)	13(21.67)	4(6.66)	1(1.67)	60(100)	3.58
For research		25(41.67)	23(38.33)	9(15.00)	3(5.00)	60(100)	3.17
Play games		10(16.67)	20(33.33)	23(38.33)	7(11.67)	60(100)	2.57
For chatting		41(68.33)	12(20.00)	4(6.67)	3(5.00)	60(100)	3.48
Listening to music		42(70.00)	12(20.00)	4(6.67)	2(3.33)	60(100)	2.80
For e-mailing		16(26.67)	28(46.67)	7(11.68)	9(15.00)	60(100)	2.86
For miscellaneous		25(41.67)	21(35.00)	12(20.00)	2(3.33)	60(100)	3.13

Effect on physical fatigue

Physical fatigue can be estimated by perceived exertion a person experiences during physical activity, including increased heart rate, increased respiration or breathing rate, increased sweating, and muscle fatigue. Although this is a subjective measure, a person's exertion rating may provide a fairly good estimate of the actual heart rate during physical activity. The Varghese RPE (Rated Perceived Exertion) scale has been widely used to study the perception of exertion in laboratory, clinical, and occupational setting.

Table 3 Distribution of respondents according to their physical fatigue while working on existing and modified computer console (Varghese scale) N = 10

Physical Fatigue	***Existing computer console***	***Computer console with accessories***	***Average reduction***	***Percent reduction***	***t' value***

Physical fatigue (based on RPE value)	3.10	2.10	1.00	32.25	3.012*

* Significance at 5% level of significance

Data regarding physical fatigue in Table 3 indicated that mean score concerning physical fatigue of selected respondents was found to be 3.10 while working on existing model of computer console, whereas, while working on modified computer console mean score came out to be 2.10 indicating average mean reduction (1.00).The percent reduction was worked out 32.25. 't' test was carried out to test the significant difference in physical fatigue between existing and modified computer console. 't' value = 3.012 at 0.05 level depicted that the modified computer console is effective to bring down physical fatigue values-significantly indicating that modified computer console was effective for reduction in physical fatigue indicating that there are differences between existing and modified computer consoles with regards to physical fatigue experienced by respondents.

Satisfaction level and subjective responses of selected respondents were taken and mean scores were worked out. The data in this regard has been given in Table 4.19, which indicates that satisfaction level of respondents was found to be more while working on modified model of computer console as compared to existing model of computer table. Further, it is seen that satisfaction score was found to be maximum for foot rest (5.0 mean score), followed by spot light (4.9 mean score), for document holder (4.8 mean score), for UV rays protector (4.7 mean score), for cushion (3.6 mean score). 't' test was carried out to test the significant difference in satisfaction level between existing and modified computer console for different accessories. 't' value = 11.52 at 0.01 level for UV rays protector, 12.04 at 0.01level for spot light, 13.07 at 0.01 level foot rest, 0.36 at 0.05 level for cushion and 11.69 at 0.05 level for document holder, depicted that the modified computer console with accessories showed significant difference in satisfaction level indicating that modified computer console was more suitable than existing computer console. The reason for satisfaction of respondents while working on modified model of computer consoles can be attributed to comfortable height of the computer console and also that of keyboard as well as the provision of different accessories

Table 4 **Satisfaction level (mean score) of respondents while working on existing (without accessories) and modified (with accessories) computer console**

Computer console		***Computer console***		***t' value***
Without Accessories	***Mean score***	***With Accessories***	***Mean score***	
No uv-rays protector	1.8	**With uv-rays protector**	4.7	11.52*
No spot light	2.7	**With spot light**	4.9	12.04*
No foot rest	3.4	**With foot rest**	5.0	13.07*
No cushion	3.5	**With cushion**	3.6	0.36
No document holder	2.9	**With document holder**	4.8	11.69*

* Significant 1% level of significance

Conclusion

Based on the result of present study it is found that majority of respondents felt exertion in body while working on computers and significant reduction was found in physiological stress and exertion while working on computer console all required accessories. Computer users should take a minimum 15 minute break from working after 2 hour of continuous computer work. It found that at least some improvement in body part discomfort levels could be attributed to rest breaks (Barredo & Mahon, 2007). In order to encourage ergonomic practice among employee, the organization should provide enough accessories such as document ramp, headset, speakerphone and footrest in designed computer workstation to better maintain and follow ergonomic standards (kearney, 2008). Accessories must be placed within a comfortable reach of both hands so that there is no unnecessary twisting of any part of the body. For future research, work environmental factors such as noise, facilities design, humidity, temperature and lighting can be selected to be one of the variables to determine the physical exertion.

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