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Computer Workstation Ergonomics: Knowledge Testing of State Agricultural Universities (SAU) Students

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ABSTRACT There is a huge influx of computer workstation designing and related health and safety issues of users. An increased number of ergonomically designed computer workstation in the work areas has limelighted the health concerns of users, but still there is a need to implant an awareness program for the users because problems associated with computer work areas are generally temporary and can easily be solved using simple corrective measures. Further, the present investigation was planned with intense objective as to assess the knowledge of students of G.B.P. University of Agriculture and Technology about the use of ergonomically sound computer workstation, and postural assessment using participative ergonomics technique of RULA. A multistage purposive cum random sampling technique was used to select the sample and personal interview cum observation method along with Rapid Upper Limb Assessment Technique for postural assessment were used on target group. It was found out of the investigation that majority of the users do not have adequate knowledge about positioning of computer workstations as more than 50 percent of the students were not aware about tilt tray arrangement, convex beck-rest and concave seat pan, placement of monitor 2-3" below eye level, work reach envelope for computer related accessories and most of the computer operators complained about upper body extremities problems. Further it was observed from study that majority of the computer users (students under investigation) do not have adequate information about positioning of computer workstations (angle, distance of monitor etc.) and most of the computer operators having complaint about upper body extremities (pain in neck, shoulder, and upper and lower back) problems.

INTRODUCTION

Ergonomics is the study of the relationship between people and the tools of their occupation. In particular, ergonomics focuses on the physical interface between the worker and the way he or she uses the tools of their job. A tool such as a computer workstation is said to have good ergonomic design when it can be easily adjusted to fit the user. With good ergonomics, the user does not have to contort their body or perform repetitive movements in ways that could cause discomfort, strain, or injury. Musculoskeletal injury and visual fatigue are the primary concerns associated with computer workstations. Fortunately, these all can be controlled through proper workstation design and use. Important step in ergonomic evaluations is to establish the optimum posture of the operator. This ensured heights and angles of equipment, for instance chair, table, copy holder, keyboard, monitor, and the like fit the individual, which in turn helps increase comfort and productivity.

Since the ages, computer workstations have become an integral part of our concern. An increased number of computer workstations in the workplace have resulted in health concerns related to vision and body aches and pains (Dockrell and Kelly 1991).

Genaidy and Karwowski (1993) investigated the discomfort associated with postures at joint, which deviated from the natural position. It was revealed that in static position, lumber extension was perceived to be more uncomfortable than lateral lumber bending or rotation. The accurate measurement of workers' exposure to the

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risk assessment as Work-related Musculoskeletal Disorders (WMSDs) has been of vital importance. Musculo-skeletal system primarily with the dimensions, compositions and the mass properties of body segments, and the work related musculoskeletal disorders are usually caused due to frequent bending, pulling or pushing of muscles, over exertion, adoption of asymmetric and awkward postures and unsupported positions used for task completion. Such postural hazards are the outcome of longer periods of unsuitable working postures which can cause pain and disability even for lifetime.

This critical review of the literature identified a number of specific physical exposures strongly associated with specific MSDs (Musculo-Sketal Disorders) when exposures are intense and prolonged, as in case of computer operator. This scientific knowledge is being applied in preventive programs in a number of diverse work settings, even then, along with these facts, the in depth knowledge of computer work behavior is essential to protect and prevent the same.

Quite a good number of studies have been conducted in India and abroad on computer workstation designing and occupational health hazards but there is still very limited information available in the literature regarding knowledge of users.

Keeping such types of thoughts and ideas in mind, the present study was planned with the following specific objectives:

- To assess the knowledge of SAU (State Agricultural Universities) students about the use of ergonomically sound computer workstation.
- To suggest them right postures and supported positions to avoid MSDs.

METHODOLOGY

A multistage purposive cum random sampling technique were used to select the sample. Out of 53 Agricultural Universities, G.B. Pant University from North India was purposively selected and 60 female students in the age group of 25-30 years (continuing research for Ph.D.), of G.B. Pant University, no statistical sampling were adopted, actually who (the students) were persuaded to participate in the study, were selected. The selected students were regularly using computers (more than 3 hours a day) for research work. The data was collected through a structured interview schedule containing statements regarding computer work behaviour along with Rapid Upper Limb Assessment (RULA) Technique for postural assessment.

RULA is a method designed to provide a quick analysis of the demands on a person's upper limb. It provided an objective measure of the Musculo-Skeletal Disorder risk caused by tasks where the demands on the upper body are high but the whole body demands (that is, the back and legs) are relatively low. RULA technique is primarily assessed the upper limb (hand, wrist, elbow, shoulder), but also the neck and low back (due to trunk postures). Typically, the person is seated or standing without much movement when performing the task as the computer work operator.

Further, due to prolonged working on computer workstation pain and associated discomfort need to be assessed. Pain experienced by respondents in different body parts were measured with the help of suitable body map and to ascertain the degree of severity of pain, a five point scale given by Verghese et al. (1996) was used. Simple averages, percentages and mean score were applied to analyze the data.

RESULTS AND DISCUSSION

The results regarding preliminary survey of respondents with the use of questionnaire/interview cum observation schedule furnished information on knowledge of student regarding computer work behaviour as ergonomically designed workstation, visual display terminal and visual control and risk factors and work postures were assessed and enclosed in Table 1. It can be revealed from the table that major proportion, as more than 50 percent, of the students were not aware about tilt tray arrangement, convex beck-rest and concave seat pan, placement of monitor 2-3" below eye level, work reach envelope for computer related accessories. however, more than 40 percent either disagreed or were undecided about source of light from top/back top of monitor, provision of document holder, 18-30" distance of monitor from eyes and suitable elbow angle while working with computer.

It can be concluded from the table that majority of the users do not have adequate knowledge about computer work behaviour.

Table 1: Knowledge of students regarding computer work behaviour (N= 60)

S. No.	*Criteria*	*Statements*	*Percentage of students*		
			A	*DA*	*UND*
1	*Ergonomic Workstation*	Tilt tray- ideal keyboard arrangement	12.0	28.7	59.3
		Convex and padded backrest	33.6	14.0	52.4
		Adjustable height of table and chair	84.5	15.5	-
		Placement of monitor 2-3 " below eye level	31.6	12.8	55.6
		Operator should sit at arm length from monitor	68	15.8	16.2
		Concave and padded seat pan	28.5	67	4.5
		Padded arm rest	100	-	-
2	*Visual Display Terminal and Visual Control*	Source of light from top / back top of monitor	63.5	27.8	8.7
		Antiglare screen of computer	100	-	-
		Provision of document holder	37.6	29	33.4
		18-30" distance of monitor from eyes	54	14	32
		Rough finish on work surface	94.5	5.5	-
		Work reach envelope for computer related accessories	34	3.2	62.8
3	*Risk Factors and Work Postures*	90° elbow angle is suitable	55.7	34.6	9.7
		Lumber support is required	98.5	-	1.5
		Awkward postures and unsupported positions should be avoided	100	-	-

Note: A- Agree, DA- Disagree, UND- Undecided.

The incidence and magnitude of musculoskeletal pain in the body while performing selected activity was recorded by administering a body map and was calculated on 5 point scale given by Verghese et al. (1996). The results regarding musculoskeletal pain in affected body parts while performing task have been presented in Table 2 and Figure 1.

It was observed that mild to moderate pain was experienced by selected respondents in neck, shoulder, hand/wrist, knee and ankle and lower and upper back due to faulty postures adopted for completion of activity.

Larson and Hannihen (1995) observed that "excessive musculoskeletal stress at work, especially, with static load, is believed to play a

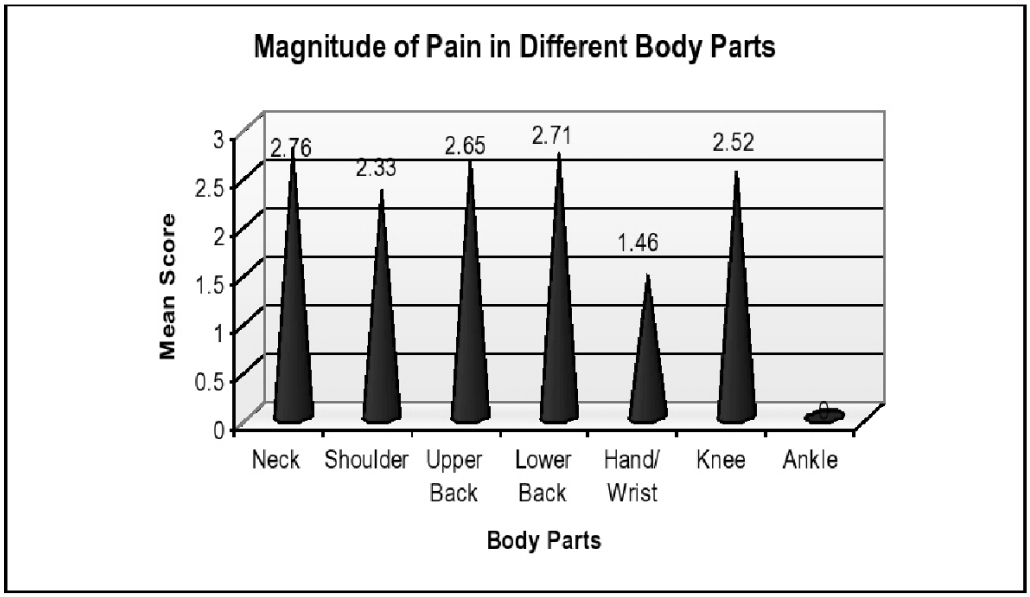

Fig.1. Magnitude of pain in different body parts

Table 2: Incidences of pain in different body parts (N=60)

Body parts	*Incidence of pain*		*Very mild*	*Mild*	*Moderate*	*Severe*	*Very severe*	*Mean Score*
	Yes	*No*						
Neck	37	23	2	7	28	-	-	2.76
Shoulder	42	18	7	15	19	1	-	2.33
Upper Back	43	17	5	8	27	3	-	2.65
Lower Back	53	7	5	8	37	3	-	2.71
Hand/ Wrist	22	28	18	13	1	-	-	1.46
Knee	58	2	12	8	35	2	1	2.52
Ankle	0	60	-	-	-	-	-	NP

NP – No pain, 1-very mild, 2-mild, 3-moderate, 4-severe, 5-very severe

major role in low back pain, neck and shoulder disorders".

Asymmetric postures and unsupported positions can increase the load on spine. Postural stress can increase the physiological cost and fatigue while performing the task and may also lead to pain and injuries to vertebral column in the long run (Joshi 2006).

Phesant (1991) observed that "Postures which are initially adopted for occupational reasons may become habitual outside the working context and finally become irreversible owing to the shortening and fibrous contraction of muscles and soft tissues."

In the present investigation RULA technique was used for assessing postural stress and Various postures including upper arm, lower arm, wrist in the group A and neck, trunk and leg in group B, all were observed and analyzed. It was found out of observation (see Table 3) that approximately 6 per cent of students were found to be in action level 4 (n=4) of RULA, 18 per cent were in action level 3(n=11) and 63 per cent of the students in action level 2 (n=38). However, only 11 percent was found to be in AL_1 indicating acceptable posture.

The majority were in AL_2, indicated that further investigation is needed and changes to the working environment or work practices may be required. AL_3 can be interpreted as further investigation and changes are required soon, however, AL_4 meant that investigation and changes are required immediately.

Further, as an interesting issue of very few respondents in AL_1, corresponding to the fact that a few subjects around 11 per cent worked at the computer in an acceptable posture, which is really a matter of concern. Elisjistom and Nachemson (1970) also found that unnatural postures lead to several musculo-skeletal problems. There are certain risk factors like awkward posture, force, repetitive activities and inadequate rest (Mukhopadhyay et al. 2007). Further Aaras and West Gaurd (1988), Keyserling et al. (1988), Ryan (1989) and Burdorf et al. (1991) supported the above said facts by stating that poor body posture was the major cause of musculoskeletal disorders.

As the computer workstation set-up is installed by University and students are working in these set-up, so training was provided to the students to know the risk associated with inadequate posture and some moderate exercise and good posture (deep breathing, upright posture with lumber support, stretching of fingers) and the resting allowance of 10 minutes after each hour of work were taught to the students to overcome the negative physiological effect.

CONCLUSION

Out of the investigation, it can be concluded that majority of the computer users do not have

Table 3: RULA score for postural assessment of students working on computer N=60

Action Level(s)	*Score*	*Zone*	*No. of students*	*Percentage*
AL_1	1-2	Acceptable	7	11.6
AL_2	3-4	Investigate further	38	63.3
AL_3	5-6	Change soon	11	18.3
AL_4	7	Change immediately	4	6.7

adequate information about positioning of computer workstations (angle, distance of monitor etc.) and most of the computer operators complaint about upper body extremities (pain in neck, shoulder, and upper and lower back) problems.

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