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Awareness on Computer Ergonomics and Prevention of MSD among the Millennials in Bangalore

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ABSTRACT

Have Gadgets made Computer Ergonomics more visible? Previously Ergonomics was applied in the manufacturing industry for workers working on heavy machines. Slowly it came to textile, construction industries and to administration streams in organizations. Nowadays it is applied in Virtual Realities (VR sets) and home decors. As per the statistics by Ideate labs 73.9 million use computers for work, gaming, social networking, browsing etc. People spend hours together in front of the computer without thinking about the impact on their bodies. Millennials are using electronic gadgets from the young age which may create Health issues known as Musculoskeletal Disorders like Back pain, Neck pain etc. which will be covered in the paper. The objective here is to know the awareness level about the right ergonomic postures among students while using computers / laptops, and also to carry out a critical examination of ergonomic ignorance among students. Another objective of the study is to identify if the current computer usage passes by undergraduates adapt the right ergonomic or deviate from them. If it is the latter, then issues discussed in this paper are likely to improve the awareness regarding right ergonomics. This paper will also cover various prevention steps to be taken for avoiding or reducing the musculoskeletal disorders among students for their wellbeing and also improve productivity. Research has been conducted among the under graduate students who mostly use desktop or laptop for their studies or work. The type of research is empirical in nature. The respondents are college going students. The data collection tools used were Structured Questionnaire and personal interview. Scope of research will be to create awareness of various health issues causing musculoskeletal disorders among students.

1. Introduction

Earlier people were more focused into higher pay and top employers wanted best talent pool in their companies. But the Office Ergonomic was still not considered important aspect for employees. As the result employees recruited with high talent were not performing as did earlier or else they would switch company. One important reason for less productivity and attrition was because of poor ergonomics. Always when a person leaves his/ her employer it is not always the higher package but preferring a better working environment and good office ergonomics where employees' health is not at stake.

Awareness regarding Ergonomics came into existence long back, but, implication and impact of Good Ergonomics was not taken into consideration by employer. As and when the years passed Office Ergonomics slowly took importance in organization. Now many employers take note of the working environment where employees need to work. In this paper researcher had focussed on the Musculoskeletal Disorders people face in their daily life.

The study started long back but, importance of ergonomic factors came into being just few years back. Especially the millennials are facing health issues because of poor working or sitting postures. In this study, main concern has been given to various health issues which are there among the millennials because of poor ergonomic factors around them. This paper will also study which are those crucial factors among all creates ill health.

2. Meaning of Ergonomic

Ergonomics is the science of designing and using resources to maximize safety, efficiency, comfort and prevent injuries to the human anatomy. "Ergonomics, also known as human engineering or human factors engineering, the science of designing machines, products, and systems to maximize the safety, comfort, and efficiency of the people who use them". One of the primary goals of ergonomics is prevention of workplace illness and accidents associated with repetitive stress injuries Repetitive Strain Injury (RSI). These injuries result from continuous repetition of the same motions, for instance screwing or twisting items on an assembly line. The injury may be worsened by awkward postures, such as bending or reaching. Below given are the various injuries that happen with poor ergonomic workplace.

Work-Related Injuries

1. Repetitive Strain Injury (RSI): This injury damages the nerves in hands and arms cause of repetitive motions like mouse clicking or typing for long hours.

2. Carpal Tunnel Syndrome: A pinched nerve (called the Median nerve) in the wrist. Carpal Tunnel Syndrome (CTS) is the inflammatory disorder that is caused due to repetitive stress, physical injury or any other

condition that causes the tissues around the median nerve to inflated. This ultimately results in pain, numbness, and tingling sensation in the wrist, hand, and fingers.

3. Musculoskeletal Disorders: Injuries to the spine and muscles due to an unnatural or unhealthy posture while using the computer. This is the symptom which is most common among youngster these days. The causes can be improper sitting postures and working for long hours at static posture etc. can be few reasons for this disorders.

3. Ergonomics Awareness among Millennials

As per the study the awareness is quiet high among generation Y but the implication and impact of it is not as per the level of awareness. Generation Y knows terms and has knowledge about the terms but they don't imply it on their lives as with the survey these respondents are having lots of health issues for which the reason is improper body posture and incorrect way of using the desktop / laptop. At least 50% of the world's population currently works in some form of office. Mostly the developing countries like India and China are having more population. They are working with machines and majority of them are from computer sector. In the Information Technology (IT) and Information Technology Enabled Services (ITES), people are dependent on the computers. More IT and ITES sectors are increasing in India.[10] There is a need for more awareness regarding musculoskeletal disorders and why it's happening. Current generation have obesity, eye problem which has made them to uses spectacles at early age, disfigured body, some patches in wrist because not using mouse pad and swelling in legs coz of long hours of sitting. Generation Y doesn't sit regularly for work but when they sit they finish the work without considering their health and body aches, which makes have poor health. Awareness among this generation need to be given with the cause of poor ergonomic postures. They need to be informed about various factors of Ergonomic as it's not just task and human but going deeper it's about each and every factor that comes in to complete work it can be chair, table computer, height of chair, adjustable furniture and fixtures. They need to know the proper usage of the factors to avoid injury and any type of disorder in body. So it's clear this generation need to be coached to wellbeing for longer duration by proper working style being adopted.

4. Ergonomics and its Impact on Millennials

Ergonomic is to some degree has got importance not just for gadget worker's but in every sector where human is engaged with. Earlier the term was used only in production sector for equipment's and various ways to make work more standardized and reduce injuries. Slowly various other sectors got to know the importance of the benefit of organization and employees. When the 1st computer was invented it was bulky and people had many health issues like arm strain, repetitive work, eye strain etc. Slowly there came the next version known as desktop which was again bulky but comparative to 1st generation computer it was less weight but, still had health issues like neck and shoulder pain and tiredness which was the cause of improper usage of technology. So the more we use technology, we need to be more aware about the usage and health issues which can be faced by the user after long time. In Chacko E (2014)[4] impact of ergonomics is been studied on the organization those are given below:

1. Reduces costs - By systematically reducing risk factors caused by poor ergonomics, people can work efficiently at all the work taken by them.
2. Improves productivity - Prevention is better as millennials get to know and enhance their knowledge about effects of poor computer ergonomics, they will avoid those factors which in turn rewards with higher productivity.
3. Improves quality- There are times millennials get frustrated about their work and discontinue or will not reach their goal. Reasons can be fatigue or no proper work station, no proper training and many more reasons concerned with the components of ergonomics. So when proper working environment is provided with adequate knowledge, quality of work improves which gives the individual to build confidence in them.
4. Improves student engagement - Surrounding counts when people work in any organization or at home. If people are provided with proper gadgets like mouse pad, right of table and chair, antiglare monitor, stand for the laptops to not get heated etc. which in turn makes the individual give their best in task given to them.

5. Literature Review

1. Ashraf A. Shikdar& Mahmoud A. Al-Kindi (2007) conducted a study on Office Ergonomics: Deficiencies in Computer Workstation Design. The study identified the ergonomic deficiency in computer workstation in typical offices. They also did study on employees who work on computer for 4 hours having nonadjustable chairs and unsupported backs. They brought our various strategies to reduce or eliminate the ergonomic deficiencies in computer workstation.
2. Bhagat Y. B., Patil S. G. (2015), conducted a study on A Literature Review on Ergonomically Study of VDT Workstation Operators.The study was conducted on both male and female. They studied on visual fatigue with blue light and greatest red color. The work posture while working siting , standing, screen height and all were studied.
3. Chacko.E (et al 2014), conducted study on awareness of ergonomics among bank employees and impact of good ergonomics on the productivity. The study was conducted ergonomics factors. Based on the study it was concluded that employees were ignorant about term ergonomics and stress on eyes and it was concluded that sitting on inappropriate posture on chair does impact on the health of the employees.
4. Chacko.E (et al 2015), conducted a study on Proactive Ergonomics for sedentary ergonomics for banking employees. The study was only for employees who majority have sitting jobs. The main concern of the study was to study the satisfaction

among the employees by proper ergonomic communication to employees time to time.

5. Chacko. E (2016) conducted study on initiative taken by HR personnel for better ergonomic work condition for their employees. The study did the comparison of three banking sectors Public, Private and Foreign Banks. Study included the awareness of ergonomics and HR suggestions and implementation in workplace. The study concluded that foreign banks give more concern to workplace ergonomics than other two sectors.
6. Michelle M Roberts, Michael J.O'Neill (2003) conducted a study on Reducing Muskuloskeletal discomfort and Effects of an office ergonomics workplace & Training interventions. The study focused on importance of training intervention on workers how to reduce musculoskeletal pain and discomfort. They designed an instructional system for having better office ergonomic training for employees.
7. Michelle Robertson (et al 2007) conducted a study on "The effects of an office ergonomics training and chair intervention on worker knowledge, behavior and musculoskeletal risk". The study was on ergonomic training using instructional system design model. The pre and post training knowledge test was also administered.
8. N Mahmud, D T Kenny, R Heard(2011) conducted a study on Office Ergonomics Awareness and Prevalence of Musculoskeletal Symptoms among Office Workers in the Universiti Teknologi Malaysia. The study concluded that the awareness among the workers is very low, which increased the rate of musculoskeletal disorders more among the workers. They did focus on longer time spent sitting and typing, lack of breaks which were the reason for poor ergonomics which led to health issues. The study made concluded to have more training sessions for workers awareness.
9. Qomariyatus Sholihah (et al 2016) conducted a study on Ergonomics Awareness as Efforts to Increase Knowledge and Prevention of Musculoskeletal Disorders on Fishermen. The study was conducted on Fisherman to counseling on ergonomic work and knowledge of musculoskeletal pain and discomfort during course work. The study conducted towards fisherman was important as their work is risky and need to have proper body postures which will help them to have safer health and higher performance in their field.
10. Vimalanathan and Babu, J Ergonomics (2017), conducted a Study on the Effect of Ergonomics on Computer Operating Office Workers in India. As per the study it was concluded as main ergonomic factors such as Physical, Environmental, Cognitive, Organizational ergonomics factor have more influence on productivity.
11. SegunOluwaseun (et al 2017) have conducted a study on Ergonomics Awareness and Employee Performance in Nigerian organization to study the various factors that hinder the use of ergonomics. The study came to conclusion that awareness and resource constraint and proper equipment designers for higher productivity.

6. Research Objectives

1. To explore students' awareness on ergonomics and its practice whilst using a computer.
2. To understand and analyze the various factors of ergonomics at workstation.
3. To identify if students are aware of the health risks of using computer workstations.
4. To examine if ergonomics factors have an impact on student productivity.

7. Hypothesis

H0: There is no difference between the awareness level of men and women related to ergonomics.
H1: There is a difference between the awareness level of men and women related to ergonomics.
H2: There is significant impact of ergonomic factors on student productivity.

8. Research Design

In order to meet the study aims, a survey of students was considered appropriate using a self-assessment questionnaire to gather quantitative data. Secondary data was collected from Magazines, Journals & Articles. With the help of data collected, a detailed analysis was made & the results are as follows. Primary data was collected from potential college students from various colleges/universities across Bangalore city. A detailed questionnaire was used to collect data from the respondents. The questionnaire is divided into 3 parts as Personal details, Awareness level, Impact of ergonomics on musculoskeletal disorders. The sample size for the study is 67 samples units using Stratified Sampling. The type of research conducted is exploratory research. The research technique used is Regression Analysis. The respondents were undergraduate students from various colleges/Universities in Bangalore who use laptops/desktops for various purposes.

9. Ethical Considerations

- It is imperative in all research that those involved are in no manner harmed by the process.
- The respondents to the questionnaire were assured of anonymity and confidentiality by not requesting any personal information from which they could be identified.

10. Limitations

- The research is conducted in various colleges/universities across Bengaluru city.
- The sample size taken for the analysis is less as compared to the total population from the selected area.
- There is a 10 % possibility of biased response from the respondents, as the questions in the questionnaire are quite sensitive in nature.
- Though the sample size chosen was 100 samples, completely filled in responses were only 67 samples.

11. Analysis and Inference

Demographic factors:

Table 1: Showing the demographic profile of the respondents

Particulars	Respondents	
	Frequency	%
AGE		
Between 18-24	66	98.50%
Between 25-31	01	01.49%
Gender	Frequency	%
Female	23	34.32%
Male	44	65.67%
DEGREE/QUALIFICATION	Frequency	%
BBA	43	64.17%
B.Com	11	16.41%
B.Sc	2	2.98%
MBA	5	7.46%
Other	6	8.95%

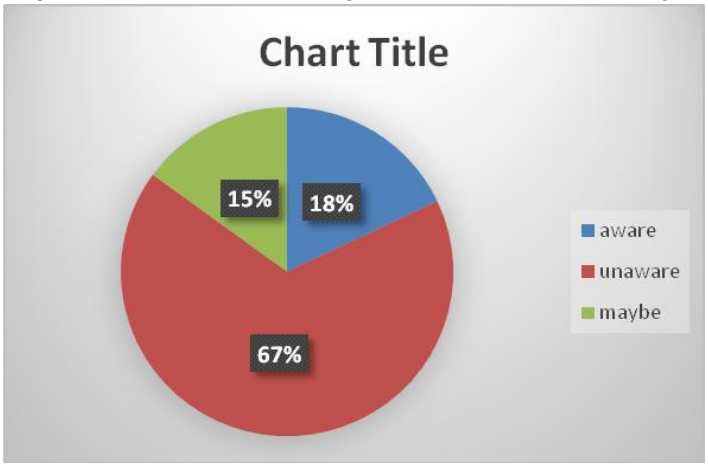
Inference:

From the above table it is inferred that almost all the respondents belong to the age group of 18-24(98.50%). Majority of the respondents (65.67%) are male. Majority of the respondents belong to BBA course.

Table 2: Showing the awareness level about ergonomics and its factors among the respondents

Sl no	Awareness level	Total respondents(67)	Percentage
1	Aware	12	17.91%
2	Unaware	45	67.16%
3	May be	10	14.92%

Graph 1: Showing the awareness level about ergonomics and its factors among the respondents



Inference: From the above mentioned tale it is inferred that majority of the respondents are unaware about ergonomics and its factors

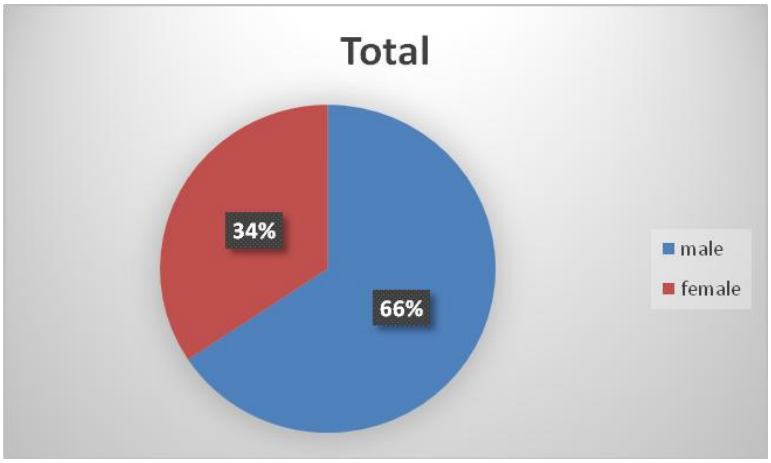
Chi-Square test for the independence of attributes [one tailed (upper tailed) test]

Attributes
A: Awareness and B: Gender of the respondents.
N- Random observations are taken from population.
2*2 Contingency Table

A/B	B1	B2	Total
A1	A	B	a+b
A2	C	D	c+d
Total	a+c	b+d	N=a+b+c+d

The test statistics is:
Chi-square= N $(ad-bc)^2/(a+b)(c+d)(a+c)(b+d)$
Chi-square variate with 1 degree of freedom and level of significance is 5%.
If Chi-square value is greater than K value (ie.3.84) then H1 is accepted.
H0: There is no difference between the awareness level of men and women related to ergonomics.
H1: There is a difference between the awareness level of men and women related to ergonomics.
Analysis:
N=67, Female=23, Male=44

GENDER RATIO OF SELECTED SAMPLE



Gender/Awareness	Aware	Unaware	Total
Male	28	16	44
Female	15	8	23
Total	43	24	N=67

So, Chi-square=$67(28*8 – 16*15)^2/ 44*23*43*24$=**0.0164**
The degree of freedom is 1
The level of significance is α = 5%
The critical value K=3.84
Since chi-square value is (0.0164) < K value (3.84), H1 is rejected.

Inference: There is no difference between the awareness level of men and women related to ergonomics. Hence based on the responses we can assume for now that gender does not play an important role in influencing the awareness level among the respondents.

Regression Analysis
H2: There is significant impact of ergonomic factors on student productivity.
X (independent): ergonomic factors
Y (dependent): Productivity

X14	The space between the front edge of the chair seat and the back of your knees
X15	The chair supporting your lower back
X16	Your arms and shoulders relaxed without interference from the arms of your chair
X17	When typing or using a mouse, keep your arms in a comfortable position
X18	With your chair adjusted properly, keyboard at approximately elbow level
X19	Arms resting at your sides rather than stretched out in front of you
X20	Shoulders relaxed and not elevated when you work at your work surface
X21	When typing or writing at your work surface, approximately there should be a 90 degree angle between your forearms and upper arms
X22	When typing at your work surface, wrists should be in line with your forearms and not bent one side
X23	At least 2 inches of clearance between the bottom of your work surface and the top of your thighs

X24	Primary work materials/input devices to be located in front of you
X25	Input devices (mouse, keyboard etc.) should be at the same level as your keyboard
X26	Should have enough room on your work surface for all your computer accessories
X27	Must take short and frequent breaks throughout the day to reduce fatigue
X28	Frequently change body positions while working
X29	Must be able to meet deadlines for assignment without excessive stress
X30	To be comfortable and free of pain while working
Y	Student productivity

Table 2: Showing the relationship between the various ergonomic factors and its impact on productivity

Regression Statistics	
Multiple R	0.684050343
R Square	0.467924872
Adjusted R Square	0.311432187
Standard Error	0.766186799
Observations	67

ANOVA

	df	*F*	*Significance F*
Regression	15	2.990075045	0.001788636
Residual	51		
Total	66		

Table 2 continued

	Coefficients	*P-value*	*Significant*
Intercept	4.933938602	4.34888E-23	
X14	0.05635209	0.753994011	No
X15	-0.1552018	0.382363972	No
X16	-0.026831463	0.872841116	No
X17	0.068675564	0.726419647	No
X18	-0.073827645	0.730606939	No
X19	-0.234619327	0.253132417	No
X20	0.318082386	0.08494019	Yes
X21	-0.237319309	0.256910135	No
X22	-0.147341208	0.371749932	No
X23	0.221996853	0.235418334	No
X24	-0.465759645	0.078583369	Yes
X25	-0.340129042	0.107001989	Yes
X26	0.585368201	0.043889827	Yes
X27	0.453326932	0.055182785	Yes
X28	-0.83660189	0.00316806	Yes
X29	0.007093941	0.968354816	No
X30	-0.304309231	0.07181766	Yes

Inference

The level of significance is 10%. If P value is less than 0.10, null hypothesis (H0) is rejected. From the above table it is inferred that, the P value of X14, X15,X16,X17,X18,X19,X21,X22,X23 and X29>0.10.

It implies that,H1 is accepted for the factors X20,X24,X25,X26,X27,X28 and X30. ie; there is a significant relationship between the above mentioned factors &student productivity. There is significant impact of ergonomic factors on student productivity.

Table 3: Showing the priorities of respondents towards various ergonomic factors

Sl No	Ergonomic factors	No of respondents Total(67)	Rank
1	Work area design	11	1
2	Eyes	19	1
3	Health	22	1
4	Lighting	16	1
5	Working hours	10	1
6	Noise (Acoustics)	9	1

Inference: Out of six ergonomic factors provided to the respondents, 22 out of 67 respondents felt that Health is the

most important factor which affects student productivity. Followed by Eyes where 19 out of 67 respondents feel that eyes is affected the most and so on.

12. Findings

- Majority (65.67%) of the respondents are male.
- Majority (64.17%) of the respondents are BBA students.
- Majority (98.50%) of the respondents belong to the age group of 18-24 years.
- Majority (67.16%) of the respondents are unaware about ergonomics and its factors.
- Many of the respondents have faced a problem due to wrong body postures like elevated shoulders, not taking frequent break to reduce fatigue, not changing body positions frequently and also not feeling comfortable and having pain while working.
- There are problems in workstation design like primary work materials/input devices not placed in front, input devices like keyboard and mouse not placed at same height/level of keyboard.
- No sufficient space on work surface for all their computer accessories.
- Majority of the respondents feel that Health (back pain, neck pain, wrist pain etc) is the most important factor which affects the student productivity

13. Conclusion

This study has clearly demonstrated that students, the majority of whom were under 24 years old, experience pain or discomfort whilst using their computers. From the above mentioned findings the authors have given some suggestions to students which could help them improve their health by adopting best practices while using their computers.

1. Eyesight :
    - Position monitor 18" to 24" away (approximately arm's length) and about 15° to 30° below your line of sight.
    - Reduce glare - Don't let light shine in your eyes or on your screen and Adjust the angle of screen to your line of vision.
2. Appropriate siting Posture:-
    1. Get a chair that properly supports your back from pelvis to shoulder blades. Sitall the way back in the chair against the backrest for support.
    2. Let your arms fall naturally (sometimes a chair without an arm rest is better), elbows bent slightly more than 90°.
    3. Keep your knees equal to, or lower, than your hips with your feet supported
3. Preventive measures such as training could be implemented as an initial step in increasing knowledge and promoting healthy work habits to reduce the prevalence of musculoskeletal symptoms.
4. If any ache in any body part consult doctor and take precautionary measures.
5. Working on computers for long hours requires vision break. So its worth to take 5 minutes break close eyes and sit.
6. The table height must not be too low which makes the user to sit shoulder bend. Make sure while working on computer user sits erect for effective working.
7. Movement of legs is required to avoid numbness.
8. Sit close to System.
9. Awareness of right ergonomic postures need to be shared among millennials.
10. Taking part in health checkup camps regularly is important

The study on ergonomics is not ending here but yes there are many more areas still untouched which will be studied and explored for the good of the society. As this study was focusing on the awareness level and the level of productivity among the millennials, which did come out worthy as in technology world we are moving forward but we are losing somewhere in our health which is precious. Hence students and everybody who uses computer of laptop in their daily use must keep in mind the above suggestions for their wellbeing.

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