

Ergonomic Adjustments and Work Efficiency in Work from Home Computer Users

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Abstract: Background: The COVID19 pandemic has displaced millions of people worldwide, forcing them to work from home (WFH) as the “NEW NORMAL”. Many workers are pushed to work in less than ideal settings during the pandemic situation. A prime component of this transitioning to WFH is the effect on worker’s work productivity, efficiency and their work ability. **Objective:** To determine the impact of ergonomic adjustments on work efficiency of computer based WFH employees. **Method:** In this cross-sectional study, 200 computer workers who switched to WFH during the lockdown period participated in an online survey. The e-form comprised of multiple categories, with questions asking about the worker’s demographics, ergonomic adjustments and their work efficiency was sent to all the participants using various social media applications. **Results:** In the present study, out of 200 subjects, 171 subjects had completed the study. The results showed that out of 171 employees, 106 employees (62%) responded as the work productivity/efficiency in the home environment compared to working in the workplace is efficient and 2 (1.2%) employees responded as more insufficient and 81 (47.4%) employees rated their work ability in relation to demand as very good and 2 (1.2%) employees rated their work ability in relation to demand as rather poor. Productivity is significantly associated with level of the screen height while working at home, lean right/left/forward/backward because of glare on the screen while working at home, rest time while working from home with $p < 0.05$. Thus, most of the ergonomic adjustments significantly increases the efficiency/productivity in working among work from home computer users. **Conclusion:** The findings indicate that the self-reported productivity and work ability of computer users working from home has been increased with the ergonomic adjustments that they have adapted at home while working.

Keywords: COVID-19, Ergonomics, Work from home, Work efficiency.

1. Introduction

A pneumonia of unknown origin, coronavirus disease 2019 (COVID-19), was initially discovered in December 2019 in Wuhan, Hubei Province, China. Later, the severe acute respiratory syndrome coronavirus-2 (SARS-CoV2) is determined to be the COVID-19’s causal agent by the international committee on taxonomy of viruses (ICTV). Not only in China but also internationally, the COVID-19 infection is spreading quickly [1]. In many countries, shutdown and self-isolation measures were swiftly put in place after the World

Health Organization declared the novel coronavirus disease to be a pandemic on March 11th, 2020. This forced many businesses to ask their employees to continue working remotely from their homes even after some quarantine measures were lifted [2]. This WFH implementation, known as the “NEW NORMAL” is thought to break up and lessen the chain of COVID-19 disease transmission. The work environment at home is one of the difficulties that come with WFH. A relaxing working atmosphere can be achieved even from home [3]. The impact of this shift to the NEW NORMAL on the workplace and employees, particularly with regard to performance, health, and well-being is a crucial consideration [4]. Office workers were required to bring their laptops with them and set up a formal desk or table at home where they could continue working. Instead, they used dining tables, chairs, monitors, and other makeshift desks that different family members use for a variety of functions while working from home. Home-based work may not be ergonomically healthy for employees if not managed effectively and in the absence of suitable resources since it causes a rapid development of physical pain that may result in serious problems down the road [5].

The profession of ergonomics applies ideas, principles, data, and methods to design in order to maximize human well-being and total system performance [6]. The availability, fitness, and proper use of various office supplies and equipment are all part of an ergonomically designed workplace. Standard time periods and postural requirements relating to the kind and use of chairs, computers, external mouse, keyboards, etc. are also included [5].

If you are working and your body is under stress from an unscientific posture, a high temperature, or repeated movement, your musculoskeletal system is adversely affected, which may result in symptoms like fatigue, discomfort, and pain which in turn may reduce your efficiency towards your work. Therefore, appropriate ergonomic settings are required to help the employees increase their work efficiency [7].

Being productive at work is essential to the operation of the organization. The personnel should produce and deliver high-quality results at the end of their shift. However, this could alter if a catastrophe strikes, such as the pandemic we are currently experiencing. Work productivity offers several insights in light

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of the current pandemic [8]. The term "work efficiency" or "productivity" refers to producing the most with the least amount of input [9]. Research on productivity done during the COVID-19 pandemic had variable results. Chinese workers' productivity declined during the COVID-19 pandemic as a result of self-regulation challenges and technological issues. Stress and sleep disorders are two fairly typical workplace-related health issues. The definition of job stress is "anything in the work environment that is felt to be harmful or that causes the employee to feel uncomfortable". According to studies, it significantly influences employee performance and productivity [10].

This study aims to examine the ergonomic adjustments of the employees who have switched to home working model during the COVID-19 pandemic and also addresses the effect of those ergonomic adjustments on the work efficiency of these employees.

2. Methodology

1. *Sources of Data:* Companies with computer users in Bangalore.
2. *Study Design:* Cross-sectional study.
3. *Criteria for Sample Selection:*

Inclusion Criteria:

- Both male and female workers.
- The workers should be within the age of 25-50 years.
- Must start working from home after the pandemic.
- Must practice desk work using a computer.
- Employees with atleast one year of experience.

Exclusion Criteria:

- Working from home part-time.
- Working from home before the pandemic.

4. *Study Setting:* Computer users working from home in Bangalore.
5. *Sample Size:* 200 subjects.
6. *Sampling Method:* Convenient sampling.
7. *Procedure:*

200 healthy subjects were included in the study with age group between 25-45 years after obtaining the consent from the subjects. Each subject was screened for and excluded if the subject had not met the inclusion criteria, then the purpose of the study was explained to the subjects. An anonymous, voluntary self-administered questionnaire (google form) was sent to the subjects through different social media platforms. The questionnaire included of open and closed ended questions. 171 subjects had completed the study.

3. Data Analysis

Statistical analysis of the data was done using SPSS 23.0. Descriptive statistics were calculated and summarized which includes frequency, percentage, mean and standard deviation. Inferential statistics had been carried out in the study. Association was done using chi-square/Fisher's exact test. Level of significance was set at 5%. The questionnaire was distributed to 171 computer users who work from home with a Mean age of 29±6.7. Out of 171 employee's majority of the

subjects 120 (70.2%) are in the age group of 20-29, 33 (19.3%) are in the age group of 30-39 years, 14 (8.2%) are in the age group of 40-49 years and 4 (2.3%) are in the age group of 50-59 years. 109 (63.7%) subjects were males and 62 (36.3%) were females.

Among the total of 171 employees, 94 (55%) employees are working 8-10 hours per day while working from home, 34 (19.9%) employees are working 10-12 hours, 33 (19.3%) employees are working 6-8 hours and 6 (3.5%) employees are working 12-14 hours. 74 (43.3%) employees are using computer for 8-10 hours per day, 64 (37.4%) employees are using computer daily for 6-8 hours, 17 (9.9%) employees are daily using computer for 4- 6 hours and 16 (9.4%) employees are using for 10-12 hours. Among 171 employees, majority of the employees 80 (46.8%) responded as the daily working hours increased 1- 3 hrs with working from home, 50 (29.2%) responded as no changes in the working hours, 5 (2.9%) responded as the daily working hours decreased 1-3 hours, 5 (2.9%) responded as the daily working hours decreased less than 1 hour and 1 (0.6%) responded as it decreased more than 3 hours.

Out of 171 employees, 47 (27.6%) used high office chair followed by 18.2% managers chair, 16.5% couch/sofa and 11.8% used small study chair while working at home. Among them, 95 (55.6%) responded as yes for the chair which they use during working from home to be comfortable and a very few 7 (4.1%) responded as definitely no for the same. Majority of the employees 104 (60.8%) responded as the level of the screen height was below eye level, 50 (29.2%) responded as at eye level and 17 (9.9%) responded as above eye level. 89 (52.4%) employees reported that they lean right/ left/ forward /backward because of glare on the screen sometimes while working at home, 44 (25.9%) of them lean often, 23 (13.5%) of them lean always, 12 (7.1%) of them lean rarely. Out of 171 employees, 75 (43.9%) employees use oversized mouse, 41 (24%) employees did not use mouse, 11.1% employees use ergonomic mouse. 114 (66.7%) employees use laptop key board, 25 (14.6%) employees use oversized key board and 22 (12.9%) employees use ergonomic key board and majority of the subjects 137 (80.1%) responded as yes for are your wrists straight and your upper arms relaxed while using keyboard and mouse and 34 (19.9%) responded no for the same.

Among 171 employees, 70 (41.2%) employees were relaxed in the home environment during the pandemic compared to the work pattern before pandemic at workplace, 44 (25.9%) employees had no difference, 37 (21.8%) employees responded as stressful, 14 (8.2%) employees responded as more stressful and 5 (2.9%) employees responded as more relaxed. Among them, 88 (51.5%) are sleeping now for 6-7 hours, 39 (22.8%) are sleeping 7-8 hours, 27 (15.8%) are sleeping 5-6 hours, 10 (5.8%) are sleeping 4-5 hours and 7 (4.1%) are sleeping more than 8 hours out of which 86 (50.3%) had a good quality of sleep, 52 (30.4%) had mostly good, 15 (8.8%) had poor, 7 (4.1%) had mostly poor, 6 (3.5%) had insomnia and 5 (2.9%) had variable quality of sleep. Among these 171 employees, majority of the subjects 90 (52.6%) are taking break every 2-3 hours, 35 (20.5%) are taking every hour, 31 (18.1%) are taking

break every 4 hours or more and 15 (8.8%) are taking break every 20-30 minutes. 65 (38%) evaluated their daily rest time while working from home as good and 9 (5.3%) evaluated as poor. Thus, the present study revealed that the ergonomic needs of the employees were met insufficiently due to rapid changes introduced by the pandemic but the employees had tried to make their own ergonomic adjustments in the available means.

Out of 171 employees, around 106 (62%) employees responded as the work productivity/efficiency in the home environment compared to working in the workplace is efficient and 2 (1.2%) employees responded as more insufficient and 81 (47.4%) employees rated their work ability in relation to demand as very good and 2 (1.2%) employees rated their work ability in relation to demand as rather poor. Productivity is significantly associated with level of the screen height while working at home, lean right/left/forward/backward because of glare on the screen while working at home, rest time while working from home with $p < 0.05$.

Thus, all the ergonomic adjustments done by the employees which may not follow the criteria of the exact ergonomic settings available while working from office significantly increases the efficiency in working from home.

Table 1
Mean age of subjects

Variable	Mean	SD	Minimum	Maximum
Age in years	29	6.7	21	57

Interpretation: Mean age of the subjects is 29 ± 6.7 .

Table 2
Age distribution of subjects

Age in years	Frequency	Percentage
20-29	120	70.2
30-39	33	19.3
40-49	14	8.2
50-59	4	2.3

Interpretation: Majority of the subjects 120 (70.2%) are in the age group of 20-29, 33 (19.3%) are in the age group of 30-39 years, 14 (8.2%) are in the age group of 40-49 years and 4 (2.3%) are in the age group of 50-59 years.

Table 3
Gender distribution of subjects

Gender	Frequency	Percentage
Male	109	63.7
Female	62	36.3

Interpretation: Majority of the subjects are males 109 (63.7%) and 62 (36.3%) are females.

Table 5

Frequency, percentage of the total working hours per day while working from home

Indicate the total working hours per day while working from home	Frequency	Percentage
10-12hrs	34	19.9
12-14hrs	6	3.5
6-8hrs	33	19.3
8-10hrs	94	55
Others	4	2.4

Interpretation: Majority of the subjects 94 (55%) are working 8-10 hours per day while working from home, 34 (19.9%) are working 10-12 hours, 33 (19.3%) are working 6-8 hours and 6 (3.5%) are working 12-14 hours.

Table 6
Frequency and percentage of total computer usage time

How would you assess your total daily computer usage time	Frequency	Percent
10-12hrs	16	9.4
4-6hrs	17	9.9
6-8hrs	64	37.4
8-10hrs	74	43.3

Interpretation: Majority of the subjects 74 (43.3%) are using computer for 8-10 hours per day, 64 (37.4%) are using computer daily for 6-8 hours, 17 (9.9%) are daily using computer for 4-6 hours and 16 (9.4%) are using for 10-12 hours.

Table 7
Frequency and percentage of working hours changed with WFH

How has your daily working hours changed with working from home	Frequency	Percent
Decreased 1-3hrs	5	2.9
Decreased less than 1hr	5	2.9
Decreased more than 3hrs	1	0.6
Increased 1-3hrs	80	46.8
Increased less than 1hr	13	7.6
Increased more than 3hrs	17	9.9
No changes	50	29.2

Interpretation: Majority of the subjects 80 (46.8%) responded as the daily working hours increased 1-3 hrs with working from home, 50 (29.2%) responded as no changes in the working hours, 5 (2.9%) responded as the daily working hours decreased 1-3 hours, 5 (2.9%) responded as the daily working hours decreased less than 1 hour and 1 (0.6%) responded as it decreased more than 3 hours.

Table 8
Frequency, percentage of the type of chair use while working at home

What is the type of chair that you use while working at home	Frequency	Percent
Bar stool (with or without backrest)	4	2.4
Bar stool (with or without backrest), Small study chair (with or without arm support)	1	0.6
Couch/sofa	28	16.5
Dinning chair(soft)	10	5.9
Dinning chair(soft), Small study chair (with or without arm support)	1	0.6
Dinning chair(soft), Small study chair (with or without arm support), Couch/sofa	1	0.6
High office chair	47	27.6
High office chair, Couch/sofa	3	1.8
Managers chair	31	18.2
Managers chair, High office chair	1	0.6
Managers chair, High office chair, Couch/sofa	1	0.6
Small study chair (with or without arm support)	20	11.8
Small study chair(with or without arm support), Couch/sofa	1	0.6
Small study chair(with or without arm support), High office chair, Couch/sofa	1	0.6
Small study chair(with or without arm support), Managers chair	1	0.6
Two different types of arm chair	17	10.0
Two different types of armchair, Bar stool(with or without backrest), Dinning chair(soft), Small	1	0.6

study chair(with or without arm support), High office chair, Couch/sofa		
Two different types of armchair, Couch/sofa	1	0.6

Interpretation: Majority 47(27.6%) used high office chair followed by 18.2% managers chair,16.5% couch/sofa and 11.8% used small study chair.

Table 9
Frequency, percentage of comfort with the chair they use while working at home

Does the chair you use while working at home meet your expectations for comfort	Frequency	Percentage
Definitely no	7	4.1
Definitely yes	37	21.6
No	24	14
Unsure	8	4.7
Yes	95	55.6

Table 4
Frequency, percentage of routine activity during the daily working time

Specify your routine activity during the daily working time	Frequency	Percentage
Answering e-mail	4	2.3
Answering e-mail, Making a presentation	2	1.2
Answering e-mail, Making a presentation, Others	1	0.6
Answering e-mail, Others	1	0.6
Data correction	3	1.8
Data correction, Answering e-mail, Others	2	1.2
Data correction, Quality check	2	1.2
Data correction, Quality check, Answering e-mail	1	0.6
Data correction, Quality check, Making a presentation	2	1.2
Data correction, Quality check, Speaking on the phone	1	0.6
Data correction, Quality check, Speaking on the phone, Answering e-mail	3	1.8
Data correction, Quality check, Speaking on the phone, Answering e-mail, Making a presentation, Others	1	0.6
Data correction, Speaking on the phone	1	0.6
Data correction, Speaking on the phone, Answering e-mail, Making a presentation	1	0.6
Data correction, Speaking on the phone, Making a presentation	2	1.2
Data entry	11	6.4
Data entry, Answering e-mail	1	0.6
Data entry, Data correction	1	0.6
Data entry, Data correction, Answering e-mail	1	0.6
Data entry, Data correction, Answering e-mail, Making a presentation	1	0.6
Data entry, Data correction, Quality check	2	1.2
Data entry, Data correction, Quality check, Answering e-mail	1	0.6
Data entry, Data correction, Quality check, Answering e-mail, Making a presentation	1	0.6
Data entry, Data correction, Quality check, Answering e-mail, Others	2	1.2
Data entry, Data correction, Quality check, Speaking on the phone, Answering e-mail	2	1.2
Data entry, Data correction, Quality check, Speaking on the phone, Answering e-mail, Making a presentation	3	1.8
Data entry, Data correction, Quality check, Speaking on the phone, Answering e-mail, Making a presentation, Others	2	1.2
Data entry, Data correction, Speaking on the phone	1	0.6
Data entry, Data correction, Speaking on the phone, Answering e-mail, Making a presentation	1	0.6
Data entry, Data correction, Speaking on the phone, Others	1	0.6
Data entry, Making a presentation, Others	1	0.6
Data entry, Others	1	0.6
Data entry, Quality check	1	0.6
Data entry, Quality check, Speaking on the phone, Answering e-mail, Making a presentation	1	0.6
Data entry, Quality check, Speaking on the phone, Answering e-mail, Others	1	0.6
Data entry, Speaking on the phone	3	1.8
Data entry, Speaking on the phone, Answering e-mail	2	1.2
Data entry, Speaking on the phone, Answering e-mail, Making a presentation	1	0.6
Data entry, Speaking on the phone, Answering e-mail, Others	1	0.6
Making a presentation	2	1.2
Others	61	35.7
Quality check	9	5.3
Quality check, Answering e-mail, Making a presentation	1	0.6
Quality check, Answering e-mail, Making a presentation, Others	1	0.6
Quality check, Making a presentation	1	0.6
Quality check, Others	1	0.6
Quality check, Speaking on the phone, Answering e-mail	1	0.6
Quality check, Speaking on the phone, Answering e-mail, Making a presentation	3	1.8
Quality check, Speaking on the phone, Answering e-mail, Making a presentation, Others	1	0.6
Quality check, Speaking on the phone, Making a presentation	2	1.2
Speaking on the phone	8	4.7
Speaking on the phone, Answering e-mail	1	0.6
Speaking on the phone, Answering e-mail, Making a presentation	3	1.8
Speaking on the phone, Answering e-mail, Making a presentation, Others	1	0.6
Speaking on the phone, Answering e-mail, Others	2	1.2
Speaking on the phone, Others	3	1.8

Interpretation: Majority of the subjects 95 (55.6%) responded as yes for the comfort with the chair they use while working at home and a very few 7 (4.1%) responded as definitely no for the same.

Table 10

Frequency, percentage of type of desk that they use while working at home

Which is the type of desk that you use while working at home	Frequency	Percentage
Coffee table	19	11.1
Coffee table, Computer table	1	0.6
Coffee table, Computer table, Laptop stand	1	0.6
Coffee table, Dinning table	1	0.6
Computer table	79	46.2
Computer table, Laptop stand	1	0.6
Computer table, Laptop stand, Dinning table	1	0.6
Dinning table	6	3.5
Height adjustable desk	10	5.8
Height adjustable desk, Computer table	3	1.8
Laptop stand	11	6.4
Small computer table	34	19.9
Small computer table, Coffee table, Height adjustable desk, Computer table, Laptop stand, Dinning table	1	0.6
Small computer table, Dinning table	1	0.6
Small computer table, Laptop stand	2	1.2

Table 11

Frequency, percentage of the type of computer they use while working at home

Which is the type of computer you use while working at home	Frequency	Percentage
Company desktop/computer	22	12.9
Company desktop/computer, My desktop/computer	1	0.6
Company laptop	96	56.1
Company Laptop	1	0.6
Company laptop, Company desktop/computer	1	0.6
Company laptop, My own laptop	7	4.1
Company tablet	1	0.6
My desktop/ computer	8	4.7
My own laptop	30	17.5
My own laptop, Company desktop/computer	3	1.8
My own tablet	1	0.6

Table 12

Frequency, percentage of the level of the screen height while working at home

What is the level of your screen height while working at home	Frequency	Percentage
Above eye level	17	9.9
At eye level	50	29.2
Below eye level	104	60.8

Interpretation: Majority of the subjects 104 (60.8%) responded as the level of the screen height was below eye level, 50 (29.2%) responded as at eye level and 17 (9.9%) responded as above eye level.

Table 13

Frequency, percentage of how often they lean right/left/forward/backward because of glare on the screen while working at home

How often do you lean right/left/forward/backward because of glare on the screen while working at home	Frequency	Percent
Always	23	13.5
Never	2	1.2
Often	44	25.9
Rarely	12	7.1
Sometimes	89	52.4

Interpretation: Majority of the subjects 89 (52.4%) sometimes they lean right/left/forward/backward because of glare on the screen while working at home, 44 (25.9%) often they do, 23 (13.5%) always they do, 12 (7.1%) rarely they do and 2 (1.2%) never done that.

Table 14

Frequency, percentage of the type of mouse they use at home

Which is the type of mouse you use at home	Frequency	Percentage
Ergonomic mouse	19	11.1
Ergonomic mouse, No mouse	2	1.2
Ergonomic mouse, Small size mouse/Mouse can be used with fingertips	2	1.2
No mouse	41	24
Oversized mouse/Fits all palm	75	43.9
Oversized mouse/Fits all palm, Ergonomic mouse	3	1.8
Oversized mouse/Fits all palm, No mouse	2	1.2
Oversized mouse/Fits all palm, Small size mouse/Mouse can be used with fingertips	1	0.6
Small size mouse/Mouse can be used with fingertips	26	15.2

Interpretation: Majority of 75(43.9%) used oversized mouse followed by 41(24%) did not use mouse, 11.1% with ergonomic mouse.

Table 15

Frequency, percentage of the type of keyboard they use at home

Which is the type of keyboard you use at home	Frequency	Percent
Ergonomic keyboard	22	12.9
Laptop keyboard	114	66.7
Oversized numpad keyboard	25	14.6
Oversized numpad keyboard, Laptop keyboard	1	0.6
Oversized numpad keyboard, Small size/No numpad keyboard	1	0.6
Small size/No numpad keyboard	8	4.7

Interpretation: 114(66.7%) used laptop key board, 25(14.6%) used oversized key board and 22(12.9%) used ergonomic key board.

Table 16

Frequency, percentage of when using their keyboard and mouse are their wrists straight and their upper arms relaxed

When using your keyboard and mouse are your wrists straight and your upper arms relaxed	Frequency	Percentage
No	34	19.9
Yes	137	80.1

Interpretation: Majority of the subjects 137 (80.1%) responded as yes for are your wrists straight and your upper arms relaxed while using keyboard and mouse and 34 (19.9%) responded no for the same.

Table 17

Frequency, percentage of stress/comfort experience in the home environment during the pandemic compared to the work pattern before pandemic at workplace

Indicate your stress/comfort experience in the home environment during the pandemic compared to your work pattern before pandemic at workplace	Frequency	Percentage
More relaxed	5	2.9
More stressful	14	8.2
Relaxed	70	41.2
Same	44	25.9
Stressful	37	21.8

Interpretation: Majority of the subjects 70 (41.2%) were relaxed in the home environment during the pandemic compared to the work pattern before pandemic at workplace, 44 (25.9%) responded as there is no difference, 37 (21.8%) responded as stressful, 14 (8.2%) responded as more stressful and 5 (2.9%) responded as more relaxed.

Table 18

Frequency, percentage of number of hours they sleep now

How many hours do you sleep now	Frequency	Percent
4-5hrs	10	5.8
5-6hrs	27	15.8
6-7hrs	88	51.5
7-8hrs	39	22.8
More than 8hrs	7	4.1

Interpretation: Majority of the subjects 88 (51.5%) are sleeping now for 6-7 hours, 39 (22.8%) are sleeping 7-8 hours, 27 (15.8%) are sleeping 5-6 hours, 10 (5.8%) are sleeping 4-5 hours and 7 (4.1%) are sleeping more than 8 hours.

Table 19

Frequency, percentage of evaluation of quality of their sleep

How do you evaluate your sleep quality	Frequency	Percent
Good	86	50.3
Insomnia	6	3.5
Mostly good	52	30.4
Mostly poor	7	4.1
Poor	15	8.8
Variable	5	2.9

Interpretation: Majority of the subjects 86(50.3%) responded as good quality of sleep, 52 (30.4%) responded as mostly good, 15 (8.8%) responded as poor, 7 (4.1%) responded as mostly poor, 6 (3.5%) responded as insomnia and 5 (2.9%) responded as variable.

Table 20

Frequency, percentage of how often they take break/ rest-time during work while working from home

How often do you take break/ rest-time during work while working from home	Frequency	Percent
Every 2-3hrs	90	52.6
Every 20-30mins	15	8.8
Every 4hrs or more	31	18.1
Every hours	35	20.5

Interpretation: Majority of the subjects 90(52.6%) are taking break every 2-3, 35 (20.5%) are taking every hours, 31 (18.1%) are taking break every 4 hours or more and 15 (8.8%) are taking break every 20-30 minutes.

Table 21

Frequency, percentage of how they will evaluate their daily "rest time" while working from home

How will you evaluate your daily "rest time" while working from home	Frequency	Percent
Better	51	29.8
Good	65	38
Mostly good	19	11.1
Much better	27	15.8
Poor	9	5.3

Interpretation: Majority of the subjects 65(38%) evaluated their daily rest time while working from home as good and 9(5.3%) evaluated as poor.

Table 22

Frequency, percentage of work productivity/efficiency in the home environment compared to working in the workplace

Indicate your work productivity/efficiency in the home environment compared to working in the workplace	Frequency	Percentage
Efficient	106	62
Insufficient	12	7
More efficient	33	19.3
More insufficient	2	1.2
Same	18	10.5

Interpretation: Majority of the subjects 106(62%) responded as the work productivity/efficiency in the home environment compared to working in the workplace is efficient and 2(1.2%) responded as more insufficient.

Table 23

Frequency, percentage of rating of work ability in relation to demand

Rate your work ability in relation to demand	Frequency	Percent
Moderate	24	14
Rather good	63	36.8
Rather poor	2	1.2
Very good	81	47.4
Very poor	1	0.6

Interpretation: Majority of the subjects 81(47.4%) rated as very good and 2(1.2%) responded as rather poor.

Interpretation: Productivity is significantly associated with level of your screen height while working at home, lean right/left/forward/backward because of glare on the screen while working at home, rest time while working from home with $p < 0.05$. The table 25 shows all these ergonomic adjustments significantly increases the efficiency in working.

4. Discussion

In this study, we evaluated the ergonomic adjustments and self-reported work productivity and work ability of computer users working from home. The study revealed that employees who switched to working from home during pandemic process were not having the proper ergonomic settings which were available to them in their office environment but they have made few adjustments in their available means.

We aimed to examine all the ergonomic aspects of working from home. Based on the findings of the study, we realized that the ergonomic needs of the employees were met insufficiently due to the rapid changes introduced by the pandemic.

Table 24
Correlation between the ergonomic adjustments and the work productivity

		Work productivity in the home environment					Total	chi square	p value
		Efficient	Insufficient	More efficient	More insufficient	Same			
level of your screen height while working at home	Above eye level	9	2	5	1	0	17	17.229	p<0.05
		52.9%	11.8%	29.4%	5.9%	0.0%	100.0%		
	At eye level	38	4	7	0	1	50		
		76.0%	8.0%	14.0%	0.0%	2.0%	100.0%		
Below eye level	59	6	21	1	17	104			
	56.7%	5.8%	20.2%	1.0%	16.3%	100.0%			
lean right/left/forward/back ward because of glare on the screen while working at home	Always	13	2	8	0	0	23	62.542	p<0.001
		56.5%	8.7%	34.8%	0.0%	0.0%	100.0%		
	Never	0	0	1	1	0	2		
		0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
	Often	24	4	8	0	8	44		
		54.5%	9.1%	18.2%	0.0%	18.2%	100.0%		
	Rarely	6	3	2	0	1	12		
		50.0%	25.0%	16.7%	0.0%	8.3%	100.0%		
Sometimes	63	3	14	1	9	90			
	70.0%	3.3%	15.6%	1.1%	10.0%	100.0%			
your wrists straight and your upper arms relaxed while using mouse	No	19	6	6	0	3	34	7.761	p>0.05
		55.9%	17.6%	17.6%	0.0%	8.8%	100.0%		
	Yes	87	6	27	2	15	137		
		63.5%	4.4%	19.7%	1.5%	10.9%	100.0%		
rest time while working from home	Better	35	1	5	0	10	51	64.826	p<0.001
		68.6%	2.0%	9.8%	0.0%	19.6%	100.0%		
	Good	46	5	6	0	8	65		
		70.8%	7.7%	9.2%	0.0%	12.3%	100.0%		
	Mostly good	9	5	4	1	0	19		
		47.4%	26.3%	21.1%	5.3%	0.0%	100.0%		
	Much better	12	0	15	0	0	27		
		44.4%	0.0%	55.6%	0.0%	0.0%	100.0%		
Poor	4	1	3	1	0	9			
	44.4%	11.1%	33.3%	11.1%	0.0%	100.0%			

Table 25
Correlation between the ergonomic adjustments and the work ability in relation to demands

		Work ability in relation to demand					Total	chi square	p value
		Moderate	Rather good	Rather poor	Very good	Very poor			
level of your screen height while working at home	Above eye level	7	4	1	5	0	17	16.731	p<0.05
		41.2%	23.5%	5.9%	29.4%	0.0%	100.0%		
	At eye level	6	20	0	24	0	50		
		12.0%	40.0%	0.0%	48.0%	0.0%	100.0%		
Below eye level	11	39	1	52	1	104			
	10.6%	37.5%	1.0%	50.0%	1.0%	100.0%			
lean right/left/forward/back ward because of glare on the screen while working at home	Always	6	7	0	10	0	23	106.069	p<0.001
		26.1%	30.4%	0.0%	43.5%	0.0%	100.0%		
	Never	0	0	0	1	1	2		
		0.0%	0.0%	0.0%	50.0%	50.0%	100.0%		
	Often	5	24	0	15	0	44		
		11.4%	54.5%	0.0%	34.1%	0.0%	100.0%		
	Rarely	3	4	0	5	0	12		
		25.0%	33.3%	0.0%	41.7%	0.0%	100.0%		
Sometimes	10	28	2	50	0	90			
	11.1%	31.1%	2.2%	55.6%	0.0%	100.0%			
your wrists straight and your upper arms relaxed while using mouse	No	9	13	0	12	0	34	6.794	p>0.05
		26.5%	38.2%	0.0%	35.3%	0.0%	100.0%		
	Yes	15	50	2	69	1	137		
		10.9%	36.5%	1.5%	50.4%	.7%	100.0%		
rest time while working from home	Better	4	26	1	20	0	51	49.578	p<0.001
		7.8%	51.0%	2.0%	39.2%	0.0%	100.0%		
	Good	11	21	0	33	0	65		
		16.9%	32.3%	0.0%	50.8%	0.0%	100.0%		
	Mostly good	5	11	1	2	0	19		
		26.3%	57.9%	5.3%	10.5%	0.0%	100.0%		
	Much better	2	4	0	21	0	27		
		7.4%	14.8%	0.0%	77.8%	0.0%	100.0%		
Poor	2	1	0	5	1	9			
	22.2%	11.1%	0.0%	55.6%	11.1%	100.0%			

These findings shows parallels to another research conducted by Davis et al. [11], which concluded that the equipment's used by the employees during work from home was not as suitable as the workplace.

The analysis of our study indicated that the majority of participants reported that their daily working hours had increased with working from home. Another study also reported that there was a significant increase in the time spent using a computer and more daily working time and meeting times compared with actual workplace experience. [2]

In the present study, majority of the subjects stated that they utilized high office chair, manager's chair and sofa/couch available at their home and most of them stated that they were comfortable with the chair that they used. Majority of the participants were using computer table, coffee table, and height adjustable desk. Most of the subjects used the company provided laptop. In a study conducted by Mehmet Akif Guler et al., [2] chair type, desk type and computer type used for working from home were mostly inappropriate and the participants largely met their needs by their own immediately available means.

Majority of the participants stated that the screen height was below eye level and most of them lean right/left/ backward because of the glare on the screen while working from home. Large number of participants used oversized mouse and only few tried using ergonomic mouse. Most of the participants used laptop keyboard, some used oversized keyboard and a few used ergonomic keyboard. Majority of the participants responded that their wrist were straight and upper arms were relaxed while using keyboard and mouse whereas only a few responded that their wrist were not straight and upper arms were not relaxed while using keyboard and mouse. All these findings illustrate that employees had no proper availability of the ergonomic equipments but tried to utilize the available means to continue their work.

In this present study, large number of participants reported that they slept for 6-7 hours while working from home, certain participants were sleeping for 7-8 hours and a very few slept for more than 8 hours. Majority of the participants have a good quality of sleep whereas very few had poor quality of sleep and certain people also had insomnia.

In the present study, majority of the participants reported that their rest time while working from home was comparatively good. Another study found that most of participants were relaxed in the home environment during the pandemic compared to the work pattern before the pandemic at workplace, some of them had no difference, for some it was stressful whereas for some it was more stressful and a few of them were relaxed. [2]

Most of the participants responded their work productivity/efficiency in the home environment compared to working in the workplace as efficient whereas others responded it to be insufficient. Majority of the participants rated their work ability in relation to demand as very good whereas others rated it to be rather poor. In a study conducted by Mehmet Akif Guler et al., [2] the participants stated that during work from home period, they were relaxed, more efficient and they outputted

better quality of work. The findings show parallels to a study conducted before the pandemic, Bloom et al., [12] compared the productivity of two groups: one working from home and the other at actual workplace and found that the working from home group was more efficient in terms of performance increase and working hours.

5. Limitation

1. Self-reported ergonomic features were observed.
2. There were a finite number of participants.
3. This study does not assess whether the workers acquired COVID while they were working from home.
4. We did not take into account how the participants' incomes changed as a result of working from home.

6. Conclusion

With the spread of the novel SARS-CoV2 virus, most office workers were obliged to shift to remote working almost overnight in mid- march 2020, and the adoption of WFH strategies is likely to persist beyond the pandemic. The present study revealed that many employees working from home had no perfect ergonomic settings that was available to them while they worked from the office but they had to adjust by their own means. The study concluded that majority of the employees had an increased work productivity/ efficiency while working from home compared to working from an office environment with the available ergonomic adjustments.

7. Recommendation

1. A future study with a larger sample size and more comprehensive demographic coverage might be able to identify the precise causes of the issues this study highlighted.
2. Further investigation could clarify and improve our knowledge of the necessity of appropriate ergonomic settings for WFH computer users.

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