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Assessment of Health Issues and Online Working Ergonomics: A Case Study of the COVID-19 in Pakistan

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ABSTRACT

The current study aims to evaluate and compare human factors and ergonomics during the lockdown of COVID-19 in Pakistan. The current research was done by conducting online surveys, using Nordic Musculoskeletal Questionnaire, Jenkin's Sleep scale, and the COVID-19 Phobia scale. Data analysis was performed statistically by employing Microsoft Excel and Statistical Package for the Social Sciences (SPSS). The sample size considered for the current study was of 421 respondents. The results revealed that various ergonomics and other health issues occurred causing depression, anxiety, insomnia, hypertension, and PTSD. The most affected body parts were the neck (58.42%), shoulders (58.25%), lower back (45.95%), upper back (35.27%), lower legs (19.98%), wrist/hands (19.61%), hips/thighs (18.42%), knees (13.48%), and ankles/feet (8.8%). It has been concluded that an ergonomically designed workstation, adequate illumination, and specific adjustment of the screen of the display screen gadgets with eye level may assist in the prevention of the observed problems. Thereby, this study suggests that exercising and ergonomics can help to control health problems, caused as an effect of the COVID-19 pandemic.

Keywords: COVID-19, ergonomics, human factors, musculoskeletal disorders, online working

1. INTRODUCTION

Improper workplace ergonomics, including online working, can have serious long-term health impacts on individuals. Due to the immediate lockdown, individuals were required to remain indoors, resulting in the need for all activities, including student classes, trainings, professional meetings, and official work to be conducted online from home [1].

In response to the COVID-19 pandemic, many sectors globally, including educational institutions and offices, were forced to shut down their in-person operations as a preventive measure to contain the spread of the virus and minimize it [2]. Initially, a complete lockdown was ensured as recommended by World Health Organization (WHO) (World Health Organization 2020). About 60% of the total populace was propelled to protect themselves from this dangerous infection. Albeit this lockdown delivered a few positive outcomes, it likewise prompted various difficulties, for example, monetary misfortune, joblessness, stress, and mental trauma [3].

In a likewise manner, Pakistan also imposed a similar strategy. When the first confirmed case of COVID-19 was reported, the government of Pakistan imposed a

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countrywide lockdown to prevent this disease transmission. Pakistan, being a developing country, has limited healthcare facilities and an unstable economy, thus many businesses and desk jobs were shifted to online work-from-home in order to avoid further economic losses [4]. Reportedly, individuals who worked from home encountered various challenges, while using online technologies and gadgets [5]. The majority of people were compelled to lead sedentary lifestyles, which are typically characterized by a penchant for comfort in all spheres, such as sitting still when using the internet and not regularly exercising. As a result, they were exposed to a significant risk of developing posture issues and other health problems [6].

Before the COVID-19 pandemic, the idea of working from home seemed like a fantasy. However, when the immediate lockdown was imposed, people were unable to adjust to the situation of working from home [7]. Certain physical issues like MSDs and severe pain in different body parts were observed during the lockdown [8]. After the examination, it was observed, that those who were working online from home were identified as having lower back torment because of prolonged sitting and a ton of energy consumption due to excessive usage of electronic equipment (computers, laptops, tabs, smartphones), rather than the other one who were not identified having coronophobia and were working from the office environment. This group was also identified as having higher coronaphobia as compared to the group, which continued to work offline from home [9].

Another study was carried out in Turkey to compare the MSDs before and during the lockdown. MSDs were found to be quite common among those who worked from home during the COVID-19 pandemic. The time spent on gadgets, such as computers, mobiles, and laptops increased drastically causing discomfort to forearms, pain in the neck, and rigidity in shoulders, causing De Quervain's syndrome and carpal tunnel syndrome. Similarly, a study carried out in Canada also revealed that computer users had suffered pain in the neck, shoulders, arms, and other body parts. [10]. There was a statistically significant rise in the severities of spinal pain, neck pain, and back pain during the isolation due to COVID-19 symptoms. Despite the fact that excessive use of smartphones and computers produced additional stress on posture, thereby, vast majority of people were willing to consider postural advice [10].

In China, a group of researchers conducted a study on assessing the lifestyle changes such as physical activities, emotional state of mind, and screen time exposure following the outbreak of COVID-19. According to the survey, people adopted a sedentary lifestyle owing to insufficient physical activities at home, more than 4 hours of screen time was observed in individuals among which young and adults have the highest prevalence of inadequate physical activities and screen exposure [11]. According to literature report, to understand the impact of online classes during COVID-19 and its effect on children, it was reported that parents were unaware that sitting with poor body posture would have a negative impact on their children's health. Many ergonomic difficulties, such as RSI (Repetitive Strain Injury), MSD (Musculoskeletal Disorders), and CTD (Cumulative Trauma Disorder) were possible with the growing age of children [12].

A study was conducted in Hong Kong to investigate the impact of online working on individuals during the lockdown period. This study investigated the ongoing

experience of the employer and employees in Hong Kong using SWOT analysis. Due to the small size of homes in Hong Kong, it has been proven challenging for employees to establish suitable workstations and work from home. An increased percentage of screen time was observed among individuals whereas people were spending less time with their families despite staying at home [13].

Aside from the physical health effects of COVID-19, many other studies have found that it has a negative impact on people's mental health. High rates of PTSD, depression, stress, anxiety, insomnia, and adjustment disorders were observed in many individuals who were working from home. Additionally, disrupted sleep patterns were common in many countries. The aforementioned symptoms were noted to be a consequence of a stress-inducing incident of the COVID-19 Pandemic, alterations in the work environment, or the passing of a dear person [14].

2. METHODOLOGY

2.1. Study Design and Data Collection

An online survey was carried out to collect the data. A Sample size of 500 individuals was gathered, out of which only 421 individuals responded. Among these, 314 were females, 103 were males, and 04 persons preferred not to inform about their gender. The age group of individuals ranged from 16-57 years. The study population was mainly divided into six groups of which 74.3% were students, 8.6% employees, 8.1% teachers, 2.4% office workers, 0.7% medical staff, and 5.9% others including freelancers, digital market workers, and engineers.

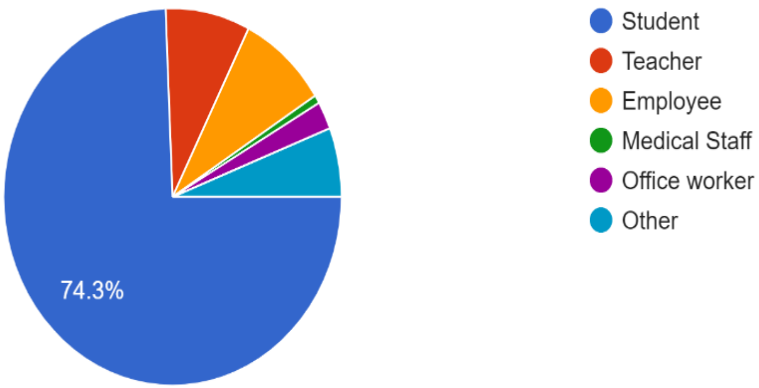

Figure 1. Categories of Individual's Responses during Survey

Web-based survey was developed through Google forms, which was distributed among selected groups of individuals. Sociodemographic data, fear of COVID-19, mental health, and musculoskeletal disorders during online working was among the key subjects. For this purpose, various scales were used to analyze the results. For example, Nordic Musculoskeletal Questionnaire (NMQ) was used for musculoskeletal disorders; [15], Jenkin's Sleep Scale (JSS-T) for assessing sleep quality [16], and the COVID-19 Phobia scale (C19P-S) were applied to study the effects fear of COVID-19 fear on mental health [17]. Data were

then analyzed statistically by applying one-way ANOVA and the Correlation test in SPSS (26.0).

2.2. Screen Time Estimations

COVID-19 was a surprise for students, occupational workers, and staff, as none of them were habitual of spending a significant amount of time in front of an electronic screen. Additionally, they were unaware of the appropriate working postures and healthy working environment. Thus, improper lighting, glare, inexact distance and angle of electronic screens from the user's eyes, resulted in irritated eyes, blurred vision, light sensitivity, and frequent severe headaches.

3. RESULTS AND DISCUSSIONS

3.1. Workstation and Working Environment

According to the findings, 41.1% of the study population used an appropriate workstation, whereas 58.9% did not have such a facility as shown in Fig 2.

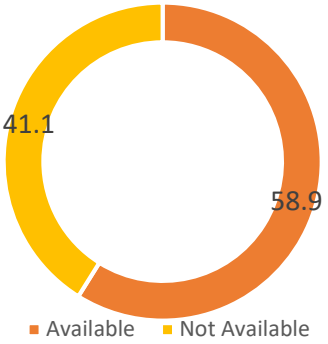

Figure 2. Proper Workstation Availability

As expected, 64.4% of the respondents said that they sat randomly, 10.7% were laying on sofa whereas only 24.9% were sitting properly (Fig 3), while working or studying. This caused many ergonomic concerns such as musculoskeletal disorders, pain in the wrist, neck, shoulders, upper back, and lower back pains [18].

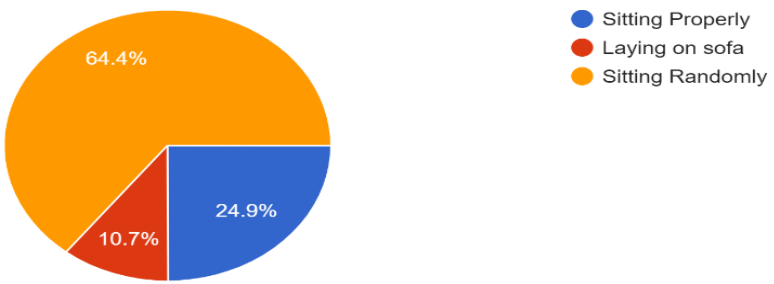

Figure 3. Sitting Posture, while Working or Studying

3.2. Screen Time

Majority of the study population used to spend less than 2 hours per day in front of a screen but during lockdown, screen usage increased to more than 8 hours. A positive correlation result was obtained between screen time before and during the lockdown, p-value = 0.00<0.05, proving the existence of a relationship between the groups, such as a perfect correlation, which is the null hypothesis.

Table 1. Correlation for Screen Time Before and During COVID Lockdown

		ST during lockdown	ST Before lockdown
Screen time during lockdown	Pearson Correlation	1	0.260
	Sig. (2-tailed)		0.000
	n	421	418
Screen time before lockdown	Pearson Correlation	0.260	1
	Sig. (2-tailed)	0.000	
	n	418	418

3.3. Fear of COVID-19

As expected, fear of COVID-19 had a significant influence on all groups of the research population as shown in Table 2. It was demonstrated that the null hypothesis was accepted except for the last group, all groups were fearful of the COVID-19. A greater 61.75% of individuals responded that it makes them uncomfortable to think about COVID-19, out of which, office workers have the highest significant value. The thought of the COVID-19 pandemic made most of them uncomfortable (p = 0.114>0.05). Thereby, this information on social media about the virus made 63.42% of people nervous, which resultantly increased anxiety (p = 0.844>0.05). Groups 4 and 6 showed the highest p-value among others. Around 80.76% of people admitted that they were afraid of the widespread infection, spreading to their families (p = 0.646>0.05) out of which group 4 showed the maximum concern as they were frontline health workers. When asked about the nature of work and fear of infecting family, groups 3 and 6 showed significantly high p-value, 44.65% of people were worried and were unable to relax with news of the current situation on a daily basis. Groups 2, 4, and 6 of the study population showed the highest percentages and they were significantly different from other groups. The p-value was 0.018<0.05 which did not support the null hypothesis.

Table 1. Affected Populations among Various Categories for Fear of COVID-19

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Uncomfortable	Between Groups	6.241	5	1.248	1.790	0.114
	Within Groups	289.422	415	0.697		
	Total	295.663	420			
Social media	Between Groups	1.431	5	0.286	0.407	0.844
	Within Groups	292.113	415	0.704		
	Total	293.544	420			
Infect family	Between Groups	1.563	5	0.313	0.671	0.646

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
	Within Groups	193.420	415	0.466		
	Total	194.983	420			
Nature of work	Between Groups	4.282	5	0.856	1.672	0.140
	Within Groups	212.568	415	0.512		
	Total	216.850	420			
Fear infected	Between Groups	0.757	5	0.151	0.217	0.955
	Within Groups	289.039	415	0.696		
	Total	289.796	420			
Trouble relaxing	Between Groups	9.710	5	1.942	2.767	0.018
	Within Groups	291.254	415	0.702		
	Total	300.964	420			

df = degrees of freedom, *F* = F-Statistic, *Sig.* = significance probability

3.4. Using Computer Screen for Long Duration

Table 3 displays the impacts of prolonged screen use. Some responses about blurred vision, light sensitivity, fatigue, and exhaustion had *p*-values more than the significant value of 0.05, which strongly supports the null hypothesis. Whereas, questions about frequent headaches and irritated eyes do not justify the null hypothesis as indicated in Table 3. A total of 71.96 % of people ($p = 0.657 > 0.05$) reported having blurred vision after using a computer screen for a longer duration. The individuals who faced light sensitivity due to increased screen time were 72.44 % ($p = 0.30 > 0.05$). Fatigue and tiredness were the major issues observed among the study population with 89.06% of the total population ($p = 0.083 > 0.05$). Increased screen time was predicted to cause frequent headaches and irritated eyes but the research group responded differently. Both had *p*-values of 0.029 and 0.03 correspondingly, which were less than the significant value. Screen use can cause visual abnormalities and other physical discomforts such as tearing, fatigued eyes, blurred vision, burning sensations, redness, double vision, and general eye fatigue. Secondary physical problems include a stiff neck, headache, backache, and general fatigue [19].

Table 2. Results of Effects During Long-Time Computer Screen Usage

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Blurred vision	Between Groups	2.179	5	0.436	0.656	0.657
	Within Groups	275.621	415	0.664		
	Total	277.800	420			
Frequent headaches	Between Groups	9.578	5	1.916	2.518	0.029
	Within Groups	314.269	413	0.761		
	Total	323.847	418			
Irritated eyes	Between Groups	9.408	5	1.882	2.508	0.030
	Within Groups	309.853	413	0.750		
	Total	319.260	418			

Light sensitivity	Between Groups	4.354	5	0.871	1.218	0.300
	Within Groups	295.374	413	0.715		
	Total	299.728	418			
Fatigue and tiredness	Between Groups	8.270	5	1.654	1.964	0.083
	Within Groups	347.825	413	0.842		
	Total	356.095	418			

df = degrees of freedom, *F* = F-Statistic, *Sig.* = significance probability

3.5. Musculoskeletal Disorders

The effects on various body parts were observed and all of the data supported the null hypothesis since the *p*-values in all of the responses were greater than the significant value of 0.05 as shown in Fig 4. The most affected body parts were the neck (58.42%), shoulders (58.25%), upper back (35.27%), lower back (45.95%), wrist/hands (19.6%), hips/thighs (18.42%), knees (13.48%), ankles/feet (8.8%), and lower legs (19.98%).

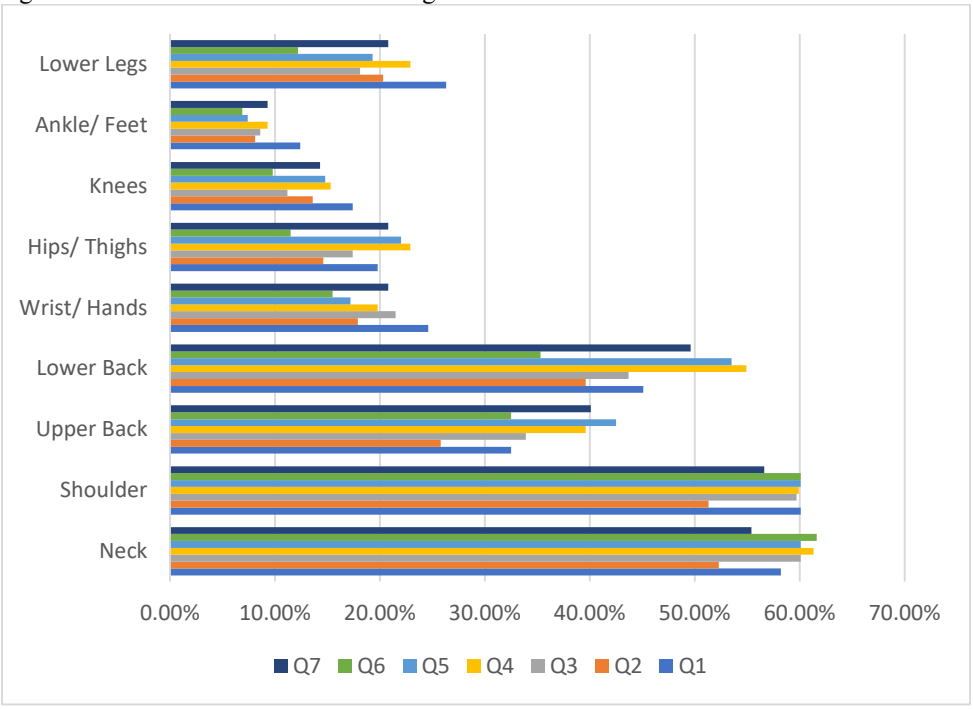

Figure 4.2 Percentage on Effects on All Body Parts Collectively

On querying about any troubles in various body parts, respondents replied with the *p*-value of 0.670, which supports the null hypothesis. Whereas, in connection with the effects on working ability, they responded with a greater *p*-value that was 0.086>0.05. The effects on people's health owing to increasing screen time had the highest *p*-value 0.983, among all the questions that supported the null hypothesis to the maximum. Working in the same position for an extended period had the greatest impact on the neck, shoulders, and lower back of individuals. Their *p*-value

strongly favoured the null hypothesis (p = 0.776).

The current study demonstrated that a p-value of 0.459>0.05 and a poor working posture has an effect on the body parts with the most severe impact on the neck and shoulders. People had to deal with unsuitable screen positions for their eyes due to a lack of proper workstations at home, which had a substantial impact on their neck and shoulders and has a p-value of 0.305. When asked about the effect of inappropriate rest breaks on their body parts, individuals supported the null hypothesis with a p-value of 0.09 and the highest percentages of aches in the shoulders and neck. MSDs are caused by inadequate ergonomic aspects of the workplace, such as sitting and placement of keyboard/input devices, monitors, accessories, such as telephone and general concepts relating to postural issues. MSD affects several joints and causes pain in the neck, shoulder, lower back, upper back, wrist/hand, knees, and elbow [20]. Previous literature has shown that the issues addressed in this section can be coped up by taking adequate breaks, exercising, and stretching body parts such as the shoulders, neck, arms, legs, upper back, lower back, ankles/feet, and hips/thighs [21].

Table 4. Groups of Population Affected by Musculoskeletal Disorder

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Faced Trouble	Between Groups	21.087	5	4.217	0.640	0.670
	Within Groups	896.349	136	6.591		
	Total	917.437	141			
Working Ability	Between Groups	46.668	4	11.667	2.074	0.086
	Within Groups	1001.398	178	5.626		
	Total	1048.066	182			
Screen Time	Between Groups	2.019	4	0.505	0.097	0.983
	Within Groups	691.148	133	5.197		
	Total	693.167	137			
Same WP	Between Groups	16.516	5	3.303	0.499	0.776
	Within Groups	668.531	101	6.619		
	Total	685.047	106			
Improper WP	Between Groups	26.500	5	5.300	0.938	0.459
	Within Groups	621.457	110	5.650		
	Total	647.957	115			
Inappropriate Position	Between Groups	31.901	5	6.380	1.215	0.305
	Within Groups	851.045	162	5.253		
	Total	882.946	167			
Inadequate Rest Breaks	Between Groups	47.365	4	11.841	2.058	0.090
	Within Groups	799.635	139	5.753		
	Total	847.000	143			

df = degrees of freedom, *F* = F-Statistic, *Sig.* = significance probability

3.6. Mental and Physical Health

Different types of mental health issues were encountered by working persons over the six-month lockdown period, which are shown in Table 5. People responded that they had sad feelings during the COVID-19

duration with a *p*-value of 0.023, which does not support the null hypothesis, as it is less than the significant value of 0.05. The question about lost interest in undertaking their normal activities was responded with a *p*-value of 0.089>0.05. People found themselves unable to stop worrying about the situation as demonstrated by a *p*-value of 0.139>0.05. Concerned with the physical health effects, people responded that they observed dryness of mouth and breathing difficulty with p-values of 0.056 and 0.219, respectively.

People felt a loss of taste and smell (p =0.498>0.05) as well as fever with cough or flu (p =0.075>0.05) as a prime symptom of COVID-19 symptom. People who experienced these symptoms and had their behaviour and everyday working routine affected may have assumed that they were infected with coronavirus due to psychological and mental abnormalities. Interrogation of whether the study population about sleeping disturbances and used to fall asleep again revealed the response of *p*-value of 0.114 and 0.122, correspondingly. Individuals experienced tiredness because of the stress and anxiety caused by COVID-19, with a *p*-value of 0.106. The findings strongly supported the null hypothesis and demonstrated that the lockdown period harmed people's physical and psychological well-being. During the COVID-19 pandemic, people suffered significant psychological distress in the form of anxiety, depression, and post-traumatic symptoms. Globally, the findings were relatively consistent in terms of severity, such as, the majority of participants had mild-moderate symptoms with just a few having severe symptoms [22].

Table 3. Groups of Individuals Suffering from Mental and Physical Health

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
Sad	Between Groups	9.501	5	1.900	2.644	0.023
	Within Groups	298.295	415	0.719		
	Total	307.796	420			
Interest or Pleasure	Between Groups	8.695	5	1.739	1.925	0.089
	Within Groups	374.977	415	0.904		
	Total	383.672	420			
Stop Worrying	Between Groups	8.039	5	1.608	1.678	0.139
	Within Groups	397.681	415	0.958		
	Total	405.720	420			
Dry Mouth	Between Groups	9.355	5	1.871	2.174	0.056
	Within Groups	357.215	415	0.861		
	Total	366.570	420			
Breathing Difficulty	Between Groups	4.809	5	0.962	1.411	0.219
	Within Groups	282.896	415	0.682		
	Total	287.705	420			
Loss of Taste	Between Groups	2.628	5	0.526	0.874	0.498
	Within Groups	249.458	415	0.601		

		Sum of Squares	*df*	Mean Square	*F*	*Sig.*
	Total	252.086	420			
Fever	Between Groups	6.671	5	1.334	2.018	0.075
	Within Groups	274.341	415	0.661		
	Total	281.012	420			
Trouble Sleeping	Between Groups	7.276	5	1.455	1.788	0.114
	Within Groups	337.732	415	0.814		
	Total	345.007	420			
Falling asleep again	Between Groups	6.816	5	1.363	1.750	0.122
	Within Groups	323.294	415	0.779		
	Total	330.109	420			
Feeling tired	Between Groups	8.328	5	1.666	1.830	0.106
	Within Groups	377.672	415	0.910		
	Total	386.000	420			

df = degrees of freedom, *F* = F-Statistic, *Sig.* = significance probability

3.7. Conclusion

The concept of remote work was introduced during the pandemic crisis, but due to its novelty, it led to physical health problems such as musculoskeletal disorders. One of the observed reasons for having musculoskeletal disorders was the lack of adequate workstations.

The most affected body parts were the neck, shoulders, upper back, lower back, wrist/hands, hips/thighs, knees, ankles/feet, and lower legs. It was concluded in the current study that all of these circumstances led towards a decline in people's mental and physical health badly by causing anxiety, depression, stress, hypertension, insomnia, and PTSD. Appropriate workstation, proper lighting, and specific adjustment of computer, laptop, and mobile screen from eye level were all necessary to overcome the aforementioned factors. Experts should give guidelines and exercises on workstation ergonomics to avoid long-term health problems.

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