ORIGINAL ARTICLE

Advanced Ergonomic Risk Assessments of Musculoskeletal Disorders via Rapid Upper Limb Assessment (RULA) and Rapid Office Strain Assessment (ROSA) Methods among Esports Players in Kuala Lumpur, Malaysia.

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Abstract: Esports is characterised by its repetitive movements, and excessive engagement in this activity may lead to the development of gaming disorders and contribute to a range of musculoskeletal conditions. This study aimed to evaluate the ergonomic risk factors associated with musculoskeletal disorders using the RULA and ROSA methods among professional Esports players. A cross-sectional study was carried out among Malaysian Esports players in Kuala Lumpur (n=84) from September 2021 to June 2023. Data was collected using a self-administered questionnaire. The posture of the participants was assessed using the RULA method, strain related to computer-based hazards and workstation environment via the ROSA method, participants' internet gaming disorder was recorded using the Internet Gaming Disorder Scale (IGDFS9-SF), and the range of the musculoskeletal pains was assessed using the Nordic Musculoskeletal Questionnaire (NMQ). Data analysis was done using descriptive statistics and logistic regression. A total of 15 (17.86%) Esports players were reported to having IGD. Based on the NMQ, the common musculoskeletal pain due to gaming during the past 12 months was related to the hand/wrist, 33 (39.2%), neck, 27 (32.1%), and shoulder, 22 (26.2%). Among the players with IGD, 9 (60%) complained of having MSD. Ergonomic assessment via RULA showed 44 (52.4%) players were classified as having high ergonomic risk, with 25 (56.8%) players were significantly associated with MSD (p = 0.045; p<0.05). ROSA method indicated that 50 (59.5%) players were classified as having a high ergonomic risk with 21 (42%) players were found to have MSD, however, the association was not statistically significant (p = 0.324, p>0.05). Esports players are at a greater risk of getting musculoskeletal complications as a result of adopting

improper posture and being exposed to a hazardous working environment. There is a significant need for interventions and increased knowledge of ergonomics to encourage better gaming habits.

Keywords: Esports, Internet gaming disorder, Ergonomic risks, RULA, ROSA, Musculoskeletal Disorders, Malaysia.

1.0 INTRODUCTION

Esports is the short form of "electronic sports" which is a competitive sport competition that focused around video games [1]. In Esports, players develop and enhance their cognitive or physical skills through the utilisation of information and communication technologies [2]. Like traditional sports, esports is possible for everyone, but only those who have mastered a certain set of skills can excel in the game. Professional online gamers claim that winning requires a great degree of coordination, cooperation, and strategic thinking [3]. In 2017, the International Olympic Committee officially recognised Esports as a professional sport [4].

Esports can benefit it players by overcoming brain conflicts related to vision and object tracing more quickly. Bavelier and Davidson [5] discovered that game-based training enabled young adults to see more minute visual details amid a cluttered environment. They also discovered that the training can help people discern between distinct shades of grey color with greater accuracy. Nevertheless, Esports game is a high-risk profession in which the players, not only tend to develop internet addiction and gaming disorders, but also posture-related musculoskeletal disorders.

A recent meta-analysis conducted by Kim et al. [6] and Stevens et al. [7] reported that the global occurrence of internet gaming disorder (IGD) was 3.3% and 3.05%, respectively. Another study by Gao et al. [8] found that the global prevalence of IGD in young adults was 10.4%, surpassing the prevalence among adolescents, 8.8%. Meanwhile in Malaysia, a higher prevalence of internet addiction (19.2%) was reported in comparison to the average prevalence estimate (17%) among Southeast Asian nations [9]. These high numbers among vulnerable groups are concerning because Esports have been associated with a variety of adverse health consequences, including poor academic performance, depression, anxiety [8,10], and poor sleep [11]. Gaming disorder was formerly classified as a mental health disorder by the World Health Organization and included in the International Classification of Diseases (ICD-11) [12].

In the context of ergonomics, sitting for several hours while performing rapid, repetitive, and dexterous movements often results in acute or chronic cervical and/or lumbar pain [13], as well as upper extremity pain including shoulder, elbow and wrist [14]. According to DiFrancisco-Donoghue et al. [15], the most prevalent complaints among Esports athletes in the United States are eye fatigue (56%), neck and back discomfort (42%), wrist pain (36%), and hand pain (32%). Esports players may also experience harmful cardiovascular complications and deep vein thrombosis due to the sedentary nature of the activity and minimal aerobic exercise. The emission of blue light from computer screen monitors can disrupt the circadian cycle, leading to insomnia, mood disorders, and weight gain [4].

Previous studies in the field of gaming have primarily concentrated on characteristics associated with internet gaming disorder. There is a lack of research on the significance of implementing ergonomic risk management in the professional gaming industry. A limited number of studies have investigated the ergonomic risk assessments of musculoskeletal disorders using the RULA technique in various populations, including students [16], dentists [17], and computer users [18]. Nevertheless, no research has been conducted to analyse the ergonomic risks associated with internet gaming disorders, that include strain assessment on computer-related hazards and the workstation environment, that could potentially lead to the development of musculoskeletal disorders among professional Esports players in Kuala Lumpur, Malaysia. Therefore, this study aimed to assess the ergonomic risk factors associated with musculoskeletal disorders among Esports players using both RULA (Rapid Upper Limb Assessment) and ROSA (Rapid Office Strain Assessment) techniques.

In view of the rapid public health concerns of gaming disorder as a form of behavioural addiction, it is crucial to conduct further research, raise awareness, and gain clinical experience regarding the musculoskeletal pain and injuries associated with this condition. Failing to address this information can lead to injuries that could have been prevented with earlier intervention.

2.0 METHODS

Study Design

A cross-sectional study was conducted between September 2021 and June 2023 in Kuala Lumpur, Malaysia. The sample size was determined using the single proportion formula. The sample

size calculated was n=84. A self-administered questionnaire was developed using the Google Forms platform and the survey link was distributed via email, QR code and social media platforms. Before administering the questionnaire, the participants were given a brief overview of the study's objectives. Consent was obtained from participants who agreed to participate in the study by having them complete the Respondent Information Sheet.

Study Participants

Individuals aged 18 years and above, residing in Kuala Lumpur, actively participating in Esports, and owning a workplace in the Esports industry are included in the study. Participants who have a previous history of musculoskeletal disorders were excluded from this study. The confidentiality and anonymity of participants were protected.

Study Instruments

Self-administered dual language (Malay and English) questionnaire was used to collect socio-demographic information, Internet Gaming Disorder (IGD), ergonomic risk factors and musculoskeletal disorders.

i. Section 1: Sociodemographic Characteristics

Socio-demographic data included age, gender, race, educational level, marital status, occupation, monthly income, and gaming characteristics such as duration of gaming and workplace environment.

ii. Section 2: Rapid Upper Limb Assessment (RULA)

The Rapid Upper Limb Assessment (RULA) was utilised to evaluate individuals' exposures to postures, forces and muscle activity that have been shown to be associated with Repetitive Strains Injuries (RSIs) [19]. The RULA ergonomic evaluation considers the biomechanical and postural load needs of occupational duties, as well as demands on the neck, trunk, and upper extremities. The scores for the upper and lower limbs, wrist, neck, trunk, and legs were as follows: 1 to 2 for minimal

risk and no action needed; 3 to 4 for low risk and possible change; 5 to 6 for medium risk and further investigation and change soon; and 6 and above for very high risk and change should be implemented soon.

iii. Section 3: Rapid Office Strain Assessment (ROSA)

The Rapid Office Strain Assessment (ROSA) is a tool for quantifying computer-related hazards and identifying a change level based on complaints of worker discomfort. Score charts are divided into four divisions [20]. Seat pan height and depth, telephone and monitor, seat pan depth, backrest and arm support, and keyboard and mouse are among the sub parts. A score of higher than 5 is considered "high risk," and the workstation environment should be evaluated further.

iv. Section 4: Internet Gaming Disorder Scale-Short Form (IGDS9-SF)

It is a validated nine items self-reported measure to assess the participants' Internet Gaming Disorder (IGD) [21]. The items were evaluated on a scale ranging from 1 (indicating never) to 5 (indicating very often). The total scores for the IGDS9-SF were calculated by adding up the responds to all nine items. These scores can vary from a minimum of 9 to a maximum of 45 points, with higher scores indicating a greater degree of Internet Gaming Disorder (IGD). The reliability of GDS9-SF is high with Cronbach's $\alpha = 0.89$ [22].

v. Section 5: Nordic Musculoskeletal Questionnaire (NMQ)

The qualitative assessment of lower back, neck, shoulder, and general problems was conducted using the standard Nordic Musculoskeletal Questionnaire (NMQ) [23]. The measure is valuable for evaluating musculoskeletal problems in epidemiological investigations. Participants were asked about any musculoskeletal conditions that hindered their usual activities in the past 12 months and the past 7 days. The reliability test showed a Cronbach's α value over 0.945, indicating outstanding reliability.

Statistical Analysis

Data analysis was performed using Jeffrey's Amazing Statistics Program (JASP). Socio-demographic characteristics were analysed using descriptive analysis and data were presented in frequency (n) and percentage (%). Logistic regression was used to find the association between ergonomic risks and musculoskeletal symptoms. *P*-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the University of Cyberjaya Research Ethics Review Committee (CRERC) (Ref no: UOC/CRERC/ER/425).

3.0 RESULTS

Sociodemographic data

A total of 84 Esports players participated in the study. Of these participants, 64 (76.2%) were men and 20 (23.8%) were female. The majority of the participants in this study were between 18 to 29 years, 75 (89.3%). The majority of the participants were Malays, 47 (55.9%), followed by Chinese, 20 (23.8%), and Indians, 17 (20.2%). Sixty-three participants (75%) were single, and 20 (25%) were married. A total of 43 (51.2%) participants had completed tertiary education, while 39 (46.4%) and 2 (2.38%) participants had completed secondary and primary education, respectively. The majority of the participants, 26 (30.9%) were students, 18 (21.4%) were self-employed, 15 (17.8%) were unemployed, 13 (15.5%) were employed in private sectors, and 12 (14.3%) were government officers. The majority of the participants earned less than RM5000 per month, 79 (94%). On average, 49 (58.3%) participants spent a maximum of 6 hours per day on gaming. A total of 53 (63.1%) participated in the ladder/ranking tournament, while 30 (35.7%) played at national level. Only one participant had joined global Esports competition (Table 1).

Prevalence of Internet Gaming Disorders (IGD)

Out of the 84 participants, 15 (17.86%) players were identified with IGD, and male gamers were four times more likely to experience IGD than female players. Furthermore, 8 (22.87%) participants who engaged in gaming for more than 6 hours per day experienced symptoms of IGD. The prevalence of IGD was highest among two ethnic groups: Chinese players, 5 (25%) and Malay players, 9 (19%). Among the participants with IGD, 11 (20.75%) participated in the ladder/ranking competition.

Prevalence of Musculoskeletal Disorders (MSDs)

Based on the NMQ, the highest prevalence of musculoskeletal pain during the past 12 months was related to the hand/wrist, 33 (39.2%), followed by neck, 27 (32.1%), shoulder, 22 (26.2%), upper back, 15 (17.9%) and lower back, 10 (11.9%). Majority of the participants complained of neck pain, 22 (26.2%) and shoulder pain, 19 (22.6%) that prevented them from carrying out normal daily activities. A total of 3 (3.6%) participants seek for medical care due to the pain related to hand/wrist. Only one participant complained of pain related to hand/risk in the past 7 days (Table 2).

Table 1: Sociodemographic Characteristics and the Prevalence of IGD among the Study Participants (N=84)

Variable		Total, n (%)	IGD	
			Yes, n (%)	No, n (%)
Age	18-29	75 (89.29)	15 (20.00)	60 (80.00)
	30-39	9 (10.71)	0	9 (100.00)
Gender	Male	64 (76.19)	12 (18.75)	52 (81.25)
	Female	20 (23.81)	3 (15.000)	17 (85.00)
Race	Malay	47 (55.93)	9 (19.14)	38 (80.85)
	Indian	17 (20.25)	1 (5.88)	16 (94.11)
	Chinese	20 (23.82)	5 (25.00)	15 (75.00)
Educational level	Primary	2 (2.38)	0 (0)	2 (100.00)
	Secondary	39 (46.43)	6 (15.38)	33 (84.61)
	Tertiary	43 (51.19)	9 (20.93)	34 (79.07)
Marital status	Never Married	63 (75.00)	12 (19.04)	51 (80.95)
	Married	21 (25.00)	3 (14.28)	18 (85.71)
Occupation	Unemployed	15 (17.86)	2 (13.33)	13 (86.66)
	Government employee	12 (14.29)	2 (16.66)	10 (83.33)
	Private sector employee	13 (15.48)	4 (30.76)	9 (69.23)
	Self-employed	18 (21.43)	4 (22.22)	14 (77.77)
	Student	26 (30.95)	3 (11.53)	23 (88.46)
Monthly personal income	RM 0-4999	79 (94.05)	14 (17.72)	65 (82.27)
	>RM5000	5 (5.95)	1 (20.00)	4 (80.00)
Duration of play (hours/day)	0-6 hours/day	49 (58.33)	7 (14.28)	42 (85.71)
	>6 hours/day	35 (41.67)	8 (22.85)	27 (77.14)
Type of Esports tournament joined	Ladder/ranking	53 (63.10)	11 (20.75)	42 (79.24)
	National	30 (35.71)	4 (13.33)	26 (86.66)
	Global	1 (1.19)	0 (0)	1 (100.00)
Workplace environment	Computer keyboards	25 (29.76)		
	Console controllers	18 (21.43)		
	Games	40 (47.62)		
	Gaming chairs	30 (35.71)		
	Gaming hardware	25 (29.76)		
	Gaming headphones	30 (35.71)		
	Gaming laptop	22 (26.19)		
	Gaming monitors	20 (23.81)		
	Gaming mouse pads	20 (23.81)		
	Gaming racing wheels	9 (10.71)		
	Mouses	18 (21.43)		
	Router	8 (9.52)		

Table 2: Prevalence of Musculoskeletal Disorders among Esports players

Site	Frequency							
	Pain* in the past 12 months		Prevented from carrying out normal activities due to the pain		Seek medical care in past 12 months		Had pain in the past 7 days	
	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)
Neck	27 (32.14)	57 (67.86)	22 (26.19)	62 (73.81)	0	0	0	0
Shoulder	22 (26.19)	62 (73.81)	19 (22.62)	65 (77.38)	0	0	0	0
Upper back	15 (17.86)	69 (82.14)	3 (3.57)	81 (96.43)	0	0	0	0
Lower back	10 (11.90)	74 (88.10)	2 (2.38)	0	0	0	0	0
Elbow	0	0	0	0	0	0	0	0
Hand/Wrist	33 (39.23)	51 (60.71)	11 (13.10)	73 (86.90)	3 (3.57)	81 (96.43)	1 (1.19)	83 (98.81)
Thigh	0	0	0	0	0	0	0	0
Knee	0	0	0	0	0	0	0	0
Ankle/Foot	0	0	0	0	0	0	0	0

**Pain: Ache, discomfort, numbness*

Association between Internet Gaming Disorder (IGD) and Musculoskeletal Disorders (MSD)

Among the players with IGD, more than half the players, 9 (60%) complained of having musculoskeletal discomfort or strain. However, there was no statistically significant association between internet gaming disorder and musculoskeletal disorders (p = 0.245; p>0.05) (Table 3).

Table 3: Association between IGD and MSD among Esports Players (n=84)

Internet Gaming Disorders (IGD)* n (%)	Musculoskeletal Disorders (MSD)			
	Yes n (%)	No n (%)	Odds ratio (95% CI)	p-value
Yes, 15 (17.86)	9 (60.00)	6 (40.00)	-0.668 (-1.805, 0.470)	0.245
No, 69 (82.14)	30 (43.48)	39 (56.52)		

**Never, rarely = No IGD. Sometimes, often, & very often= IGD*

Ergonomic Risk Assessments based on RULA and ROSA Methods

Posture evaluation with RULA method showed that 44 (52.4%) players were classified as having high ergonomic risk (scores 5 to >6), while 40 (47.6%) were classified as low risk (scores 1 to 4). Among the players with high ergonomic risk, 25 (56.8%) were significantly associated with musculoskeletal disorders (p = 0.045; p<0.05).

The strain assessment conducted using the ROSA method indicated that 50 (59.5%) players were classified as having a high ergonomic risk, with scores exceeding 5. On the other hand, 34 players (40.5%) were classified as low risk, with scores below 5. Out of the high-risk players, 21 (42%) were found to have musculoskeletal disorders, however, the association was not statistically significant (p = 0.324, p>0.05) (Table 4).

Table 4: Association between Ergonomic Risk Factors (RULA and ROSA Methods) and MSD among Esports Players (n=84)

Ergonomic Risk Assessments n (%)	Musculoskeletal Disorders (MSD)			
	Yes n (%)	No n (%)	Odds ratio (95% CI)	*p*-value
RULA				
• Low risk: 40 (47.62)	14 (35.00)	26 (65.00)	0.893	0.045*
• High risk: 44 (52.38)	25 (56.82)	19 (43.18)	(0.011, 1.776)	
ROSA			-0.441	0.324
• Low risk: 34 (40.48)	18 (52.94)	16 (47.06)	(-1.317, 0.436)	
• High risk: 50 (59.52)	21 (42.00)	29 (58.00)		

RULA
Low ergonomic risk: Acceptable posture, further investigation, change may be needed
High ergonomic risk: Further investigation, change soon, investigate further, & implement change

ROSA
Low ergonomic risk: Further assessment not immediately required
High ergonomic risk: Further assessment required as soon as possible

**Statistically significant at p<0.05*

4.0 DISCUSSION

Research in Esports is essential due to the growing participation of young athletes in training and competition. Consequently, there is a need for further studies to assess the frequency of injuries, analyse body mechanics during gameplay, and establish appropriate guidelines tailored to Esports players. This study assesses the risk of musculoskeletal disorders (MSDs) among Esports players using the Rapid Upper Limb Assessment (RULA), Rapid Office Strain Assessment (ROSA), and Nordic Musculoskeletal Questionnaires (NMQ).

The present study has shown that 17.86% of Esports players were suspected to suffer from internet gaming disorder (IGD), with over 22% of them played for more than 6 hours per day. Previous studies have reported that the prevalence of IGD ranges from 0.27% to 57.50% [10], while the prevalence of internet addiction ranges from 0.8% to 26.7% [24]. A recent study conducted among 639 Indonesian medical students revealed that, 13 (2%) of the sample population, with an average age of 20.23 ± 0.13 years and spent more than 20 hours per week playing video games, experienced symptoms of IGD [25]. In the present study, players with IGD were between 18 and 29 years old. Prior studies indicated that internet and video game addiction were more prevalent among older age groups [26-27]. Other studies among primary school students also reported a high prevalence of IGD ranging from 4% to 9% [28-29]. Multiple studies have documented that time and money are the primary elements influencing IGD [30-32]. Moreover, in order to maximise profits, the conventional gaming operation pattern typically lacks fixed endpoints, which can easily lead to gaming addiction [33]. Game addiction is also highly correlated with factors such as the desire for sensations, the need to escape reality, and as a coping mechanism from negative feelings [34].

Moreover, this study discovered that IGD indicates a higher prevalence rate among male gamers. Multiple studies have demonstrated a correlation between gender and online gaming disorder in which they have consistently found that male players make up more than double the number of participants compared to female players [26, 27, 35]. Male gamers were discovered to engage in longer gaming sessions and exhibit a greater propensity to participate in gaming communities compared to females. Genetic and neurological disparities between genders may have an influence [36, 37]. Based on functional magnetic resonance imaging study, males demonstrated

enhanced connectivity in their mesocorticolimbic pathway when playing video games compared to females [38]. This pathway is crucial in reward assessment, motivated behaviour and cognitive regulation through dopaminergic modulation [39].

Based on the findings of the Nordic Musculoskeletal Questionnaire, the regions with the highest incidence of musculoskeletal disorders (MSDs) in this study were the hand/wrist, neck, and shoulder. In particular, 60% of gamers with IGD reported having MSDs. The results of this study were consistent with previous studies that used the NMQ to assess musculoskeletal problems. Seng et al. [40] reported that the most common musculoskeletal pain experienced by Esports players were hand/wrist pain (79.7%), followed by neck discomfort (76.8%) and knee pain (11.6%). Similarly, Yang et al. [41] found that 17.4% of the 4211 Chinese college freshmen had internet addiction and the majority of them (33.9%) had shoulder pain. The high prevalence of musculoskeletal pain and symptoms can be attributed to repetitive activity in each region, prolonged engagement in static work, insufficient rest, and uncomfortable postures while working with computers [18].

In this study, more than 20% of the Esports players who experienced Internet Gaming Disorder (IGD) played an average of 6 hours per day, totalling 42 hours per week. Video gaming, being a predominantly sedentary activity, can have diverse impacts on several joints, with varied degrees of severity. Prolonged and continues gaming duration have a notable impact on the upper body postures and fatigue of the neck muscles Evidently, extended durations of video gaming led to progressive muscle overload in posterior neck due to continuous static pressure on specific sites, leading to heightened muscular exhaustion and pain [42]. Tendinosis, a condition that affects the upper extremities, can be caused by the repetitive movements of the thumb and fingers during increased gripping [43]. Furthermore, prolonged use of smartphones or computers for more than five hours per day has been linked to the development of lower back pain, potentially due to restricted movement among users [44].

According to the ergonomic risk assessments conducted in this study, the RULA method identified that 52% of the Esports players were categorised as high risk, whereas the ROSA method suggested that 59% of players were categorised as high risk. These findings are comparable to a study done by Russo et al. [45] in which participants who perceived themselves as being significantly

exposed to biomechanical and ergonomic hazards had a significantly increased likelihood of developing back pain (OR: 1.91; 95%CI: 1.62–2.24), lower limbs pain (OR: 1.63; 95%CI: 1.36–1.94) or shoulders, neck and/or upper limbs pain (OR: 1.70; 95%CI: 1.44–1.99). Furthermore, according to Hakim and Mohsen [46], a higher incidence of significant lower back pain was observed in individuals who reported uncomfortable seating while playing games (81%; OR=2.83; 95% CI: 1.43-5.59). Gerr et al. [47] concluded that the use of ergonomic workstations, including specific types of keyboards, mouse, tables, and chairs, resulted to a decrease in musculoskeletal disorders. Conversely, the use of non-ergonomic instruments was found to be associated with a higher occurrence of MSDs.

5.0 STRENGTHS AND LIMITATIONS

To the best of the authors' knowledge, this is the first study to examine the correlation between IGD and the prevalence of MSDs among professional Esports players in Kuala Lumpur, Malaysia. This study employed a demographically representative sample of professional Esports players to acquire a precise answer pertaining to the occurrence of IGD and MSDs. This study also identified the ergonomic risk factors that may impact the occurrence of MSDs among gamers using two distinct ergonomic assessments: the Rapid Upper Limb Assessment (RULA) and the Rapid Office Strain Assessment (ROSA) methods. Participants IGD and MDSs were evaluated using the standardised survey questionnaires that have been cross-culturally validated.

Several limitations should be considered in this study. First, due to the cross-sectional nature of this research and the relatively small sample size, the ability to establish causality and generalize the findings was limited. Therefore, it is imperative to do prospective longitudinal research using extensive and representative populations. Second, this study used self-reported survey which may lead to reporting bias where participants might over- or under-reporting their responses, particularly on their internet addiction and musculoskeletal symptoms. Thus, a proper examination and diagnosis by clinicians can be included in subsequent studies in order to obtain more accurate responses. Third, this study did not differentiate between various categories of gaming devices, including virtual reality headsets, PlayStations, and other new gadgets that might induce varying degrees of internet addiction and musculoskeletal symptoms. Research on the impact of new gaming devices on IGD and MSDs can be designed for future study. Finally, this study did not consider other confounding factors, such as

smoking, alcohol consumption, household income, social status, and mental health, all of which have significant impacts on gaming addiction. These data can be acquired by including follow-up investigations in future research.

6.0 CONCLUSION

This study indicates an alarming prevalence of internet gaming disorder among Esports players in Kuala Lumpur. Moreover, musculoskeletal disorders in the hand, wrist, neck and shoulder were frequently observed among Esports players with internet gaming disorder. According to the RULA and ROSA assessments, it was determined that over 50% of Esports players had a significant probability of experiencing severe ergonomic risks. These findings indicate the presence of improper and inaccurate ergonomic postural practices among professional Esports players. This study proposes an intervention programme addressing gaming-related musculoskeletal disorders (MSDs) that emphasises the application of ergonomic principles, redesigning workstations, providing ergonomic education, and implementing regular exercise routines, which can effectively mitigate the occurrence of such disorders.

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Data Availability

Dataset used in the current study are available from the corresponding author upon reasonable request due to privacy.

Conflict of Interest

The authors declare that there is no actual or potential conflict of interest in relation to this article.

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