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Research Article

Effect Of Ergonomic Intervention On Neck Pain, Discomfort And Quality Of Life Among Female Computer Users

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ABSTRACT

Background: Musculoskeletal pain is a leading cause of disability worldwide. The relationship between neck pain and computer use, arises from prolonged sitting in fixed positions without taking breaks to stretch. Spending 4 to 5 hours every day using a computer has been recognized as a dangerous aspect of neck pain. On the job, the musculoskeletal system gets impacted by repeated movements, high temperatures, or unnatural postures that stress the body. Ergonomics therefore plays a significant role in decreasing various work-related illnesses or injuries, such as carpal tunnel syndrome, neck and back pain, and computer vision syndrome.
Study Design: A Randomised controlled trial
Aim: To find out the effect of ergonomic intervention on neck pain, discomfort, and quality of life among female computer users.
Objective: To evaluate the effect of ergonomic intervention on neck pain, discomfort, and quality of life by using Neck disability index and WHO Quality of life scale respectively in female computer users.
Participants: 64 females with musculoskeletal disorders were selected based on the inclusion and exclusion criteria through random sampling method.
Method: 64 females with musculoskeletal disorders were allocated into group A and B. Group A experimental group (n=32) received ergonomic intervention while Group B control group (n=32) received conventional exercise.
Outcome Measures: Neck disability index (NDI), WHO Quality of Life scale (WHOQOL).
Result: Statistical analysis of Pre and Post-test, Neck disability index (NDI) and WHO Quality of Life Scale (WHOQOL) revealed that there is statistically significant difference seen in group A than in group B.
Conclusion: This study presents robust evidence supporting the effectiveness of the ergonomic intervention in managing neck pain and enhancing the quality of life among participants in the experimental group. The significant reductions in the (NDI) scores and the marked improvements in World Health Organization Quality of Life (WHO-QOL) assessments highlight the intervention's success in alleviating pain and fostering overall well-being.

Keywords: Ergonomic, pain, disability, computer users

INTRODUCTION

The most expensive type of disability is work musculoskeletal disorder (WMSD). further to occupational fitness issues, India has struggled with conventional public fitness problems, including infectious diseases, malnutrition, rapid population growth, and insufficient scientific treatment. One of the most important troubles with occupational fitness in India is musculoskeletal disorder (MSD), which accounts for around 40% of the cost related to treating work-related injuries, in step with estimate. [1,2]
Musculoskeletal pain is a leading cause of disability worldwide. This type of pain can be acute or persistent and affects various structures in the body, including bones, muscles, ligaments, tendons, and even nerves. It presents a significant medical and socioeconomic challenge across the globe. Musculoskeletal pain greatly

diminishes the quality of life, leading to increased difficulties in performing daily activities, higher levels of drug use, increased sick leave, and a greater need for disability benefits.[3,4]
According to this research, neck pain is described as discomfort that radiates laterally to the outer and superior surfaces of the skull, starting at the base of the occiput and ending in the upper back restrictions around the shoulder blade (scapula). Examined is the epidemiological data relevant to WRNP on computer use; and personal, social, behavioural, and mental health concerns.[5]
It could take place as popular soreness, postural fatigue affecting the neck, shoulders, and hands, or ongoing discomfort within the gentle tissues across the neck and shoulder regions. [5]
The relationship between neck pain and computer use arises from prolonged sitting in fixed positions without taking breaks to stretch. Spending four to 5 hours every day using a PC has been recognized as a great dangerous aspect of neck pain, especially in teenagers. A healthy neck maintains a moderate lordotic curve. but prolonged laptop utilization combined with rounded shoulders and poor posture can disrupt this curve, causing muscular imbalances and resulting in neck pain. preserving proper neck alignment is critical to save you such troubles. [6]
Additionally, there is a personal risk factors including being a woman, utilizing bad work habits, having co-morbid disorders, getting less sleep, eating badly, and exercising less. The prevalence of neck pain was 43%, with women reporting it at a higher rate (48%) than men (38%). Unlike men, women of working age experienced more neck pain than elderly women. The prevalence of chronic neck pain, which is defined as persistent discomfort lasting longer than six months, was higher in women (22%) than in males (16%).[7] One-third of the patients with chronic symptoms had suffered a whiplash-type injury, and almost one-fourth of the cases had a history of head or neck trauma. Long-term, untreated neck pain will weaken the neck extensors and lower the person's quality of life. [7-8]
On the job, the musculoskeletal system gets impacted by repeated movements, high temperatures, or unnatural postures that stress the body. Ergonomics therefore plays a significant role in decreasing various work-related illnesses or injuries, such as carpal tunnel syndrome, neck and back pain, and computer vision syndrome.[9] To design workspaces that are secure, comfortable, and productive while considering people's physical characteristics, such as their strength, dexterity, speed, and sense of touch, as well as their attitudes. To promote comfort and productivity among therapists. [9]
Despite the prevalence of Neck pain complaint among computer users, particularly women due to prolonged sitting, poor posture, inadequate workspace design and the effects of ergonomic interventions, this study aims to provide valuable insights into mitigating neck pain, improving comfort, and enhancing quality of life among female computer users.

METHODOLOGY

This study was reviewed, discussed and approved by the Santosh Occupational Therapy institutional ethical committee. 64 participants were selected from American Express global business travel company as per inclusion and exclusion criteria. Prior to participate in the study, participants were explained about the study. The written consents were obtained from the participants. The participants were assigned to control and experimental group by random sampling method. The inclusion criteria were women aged group 25 to 45years, who use computers for at least 4 to 5 hours per day intermittently/continuously and pregnant women, a female with rheumatoid arthritis, ankylosing spondylitis, infection, migraine, and work-related stress and anxious personality were excluded from the study.
In Experimental Group 32 participants were taken, the subjects received Ergonomic intervention and conventional exercises for 45 minutes per session, 5 days/week for 4 weeks. In Control Group 32 participants were taken. The subjects received only conventional exercises for 45 minutes, 5 days/week for 4 weeks. The outcomes of the intervention were assessed using Neck disability index (NDI) and WHO Quality of Life Scale (WHOQOL)

Intervention Program includes

- **Ergonomic Intervention-** Workstation modification [10], Precautions, Work simplification technique, Energy conservation technique [11]
- **Conventional Exercise**- Hot packs for 15 to 20 minutes at night [12], Range of motion exercise, Stretching, Warm-up, Endurance phase, Recreational activities, Rest [13]

Outcome Measures:
Neck disability index (NDI)

It is designed to provide information as to how neck pain affects a person's ability to manage in everyday life. The NDI contains 10 items - pain intensity, personal care, lifting, work, headaches, concentration, sleeping, driving, reading, recreation. Each item of NDI is scored from 0 to 5. The scoring interpretation for the NDI is as follows: 0-4 = none; 5-14 = mild; 15-24 = moderate; 25-34 = severe; over 34 = complete. The NDI was filled by the subject himself/herself. It took about 5 minutes to fill the scale.[14]

WHO Quality of Life Scale (WHOQOL)

The WHOQOL-BREF is an abbreviated 26-item version of the WHOQOL-100 containing items that were extracted from the WHOQOL-100 field trial data. Standard instructions, sociodemographic details and an item on current health status were completed before answering the 26 items of the WHOQOLBREF. The extraction of data for the WHOQOLBREF which is currently scored in four domains: Domain 1: Physical health, Domain 2: Psychological, Domain 3: Social relations and Domain 4: Environment, with all facet items scored as part of their hypothesized domain.[4]

DATA COLLECTION:

A total of 64 female participants were included in the study through random sampling. The participants were recruited from American Express Global Business Travel Company as per inclusion and exclusion criteria.

DATA ANALYSIS:

After completion of all (pre-intervention and post-intervention) evaluation, results were collected and data were put in the master chart and analysed by using IBM SPSS V26.0 version. for statistical significance result. The pre-post analysis of experimental and control group was analysed through parametric test. T-test was used to analyse the pain and functionality scores for analysis of outcome measures NDI and WHOQOL-BREF.
Throughout the course of 4 weeks, data was gathered utilizing simple supplies like a pen, paper, and table using a convenient sampling technique. After completion of all evaluations results were calculated, and data were put and analysed by using the statistical software IBM SPSS V26.0 version.

RESULT

The results indicate significant enhancements in both the (NDI) scores and the (WHO-QOL) assessments, particularly in the domains D1, D2, D3, and D4.
The results of Group A, which underwent an experimental intervention to assess pain, discomfort, and quality of life. The mean NDI score of group A before the intervention was 19.774, which decreased to 13.419 after the intervention, indicating an improvement in neck pain and disability. The variance also decreased from 47.38 (PRE) to 13.45 (POST INT), suggesting greater consistency in post-intervention scores. The pooled variance, calculated at 30.416, is an average of the variances from both groups. The t-test yields a p-value (P(T<=t) two-tail) of 2.8E-05, which is highly significant, indicating that the reduction in NDI scores after the intervention is statistically significant. The t critical value for a two-tailed test is 2.000, further supporting that the observed difference between pre-and post-intervention scores is significant.
WHO-QOL assessment across four domains (D1, D2, D3, D4) reveals improvements in quality of life following the intervention. In Domain 1, the mean score increased from 20.677 to 25.258, while in Domain 2, it rose from 19.677 to 23.129. Domain 3 showed a smaller improvement, with the mean increasing from 9.258 to 11, and Domain 4 saw the most significant change, with scores rising from 26.871 to 32.032. Across all domains, reductions in standard error and standard deviation reflect more consistent improvements in quality of life after the intervention. Overall, the data indicate that the intervention was effective in reducing pain and improving both physical and overall QOL.

Table 1.0 Paired t-Test of NDI Group A
t-Test: Two-Sample Assuming Equal Variances

Stats	**NDI**	
	PRE	**POST (INT)**
Mean	19.77419	13.41935484
Variance	47.38065	13.4516129
Pooled Variance	30.41613	
P(T<=t) two-tail	2.8E-05	
t Critical two-tail	2.000298	

Figure 1.0 Paired t-Test of NDI Group A

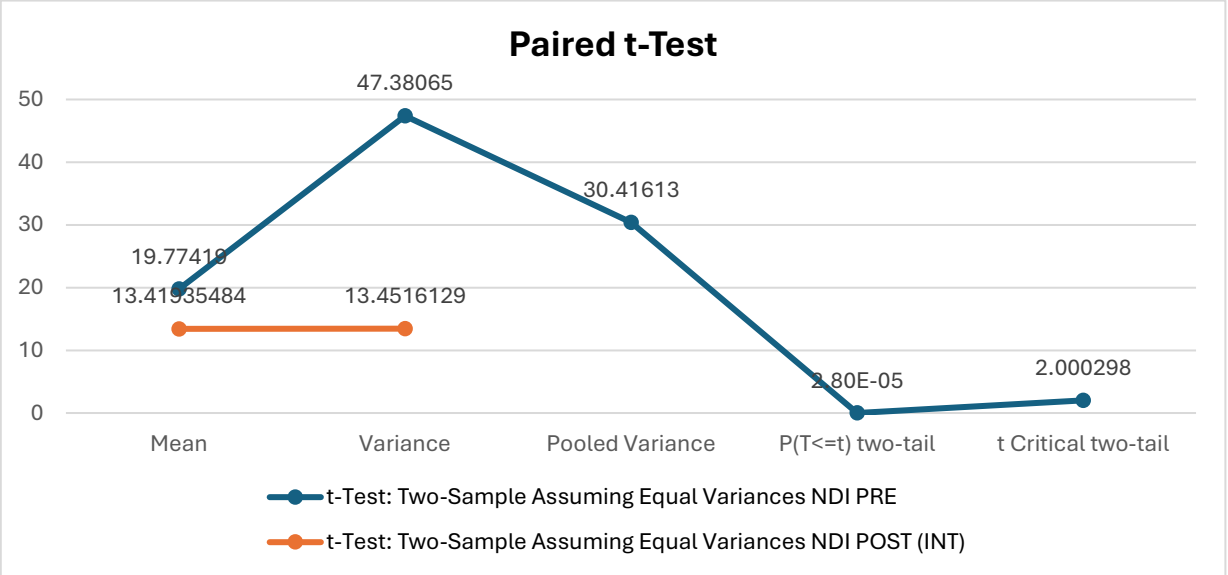

Table 2.0 Paired t-test of WHO-QOL for Group A

Group A - Experimental Group								
t-Test								
Stats	**WHO – QOL**							
	D1		**D2**		**D3**		**D4**	
	PRE	***POST (INT)***	***PRE***	***POST (INT)***	***PRE***	***POST (INT)***	***PRE***	***POST (INT)***
Mean	20.75	25.21875	19.813	23.125	9.344	11.0625	26.938	32.031
Variance	21.097	1.595766	14.738	2.822581	8.233	5.28629	23.738	9.322
Pooled Variance	11.346		8.780		6.760		16.530	
P(T<=t) two-tail	1.59026E-06		3.37E-05		0.010		4.79E-06	
t Critical two-tail	1.999		1.999		1.999		1.999	

Table 3.0 Paired t-Test of NDI Group B

Group B-Control Group		
Stats	**NDI**	
	PRE	***POST (INT)***
Mean	29.188	23.406
Variance	11.254	11.991
Pooled Variance	11.622	
P(T<=t) two-tail	5.1E-09	
t Critical two-tail	1.999	

Figure 2.0 Paired t-Test of WHO-QOL for Group A

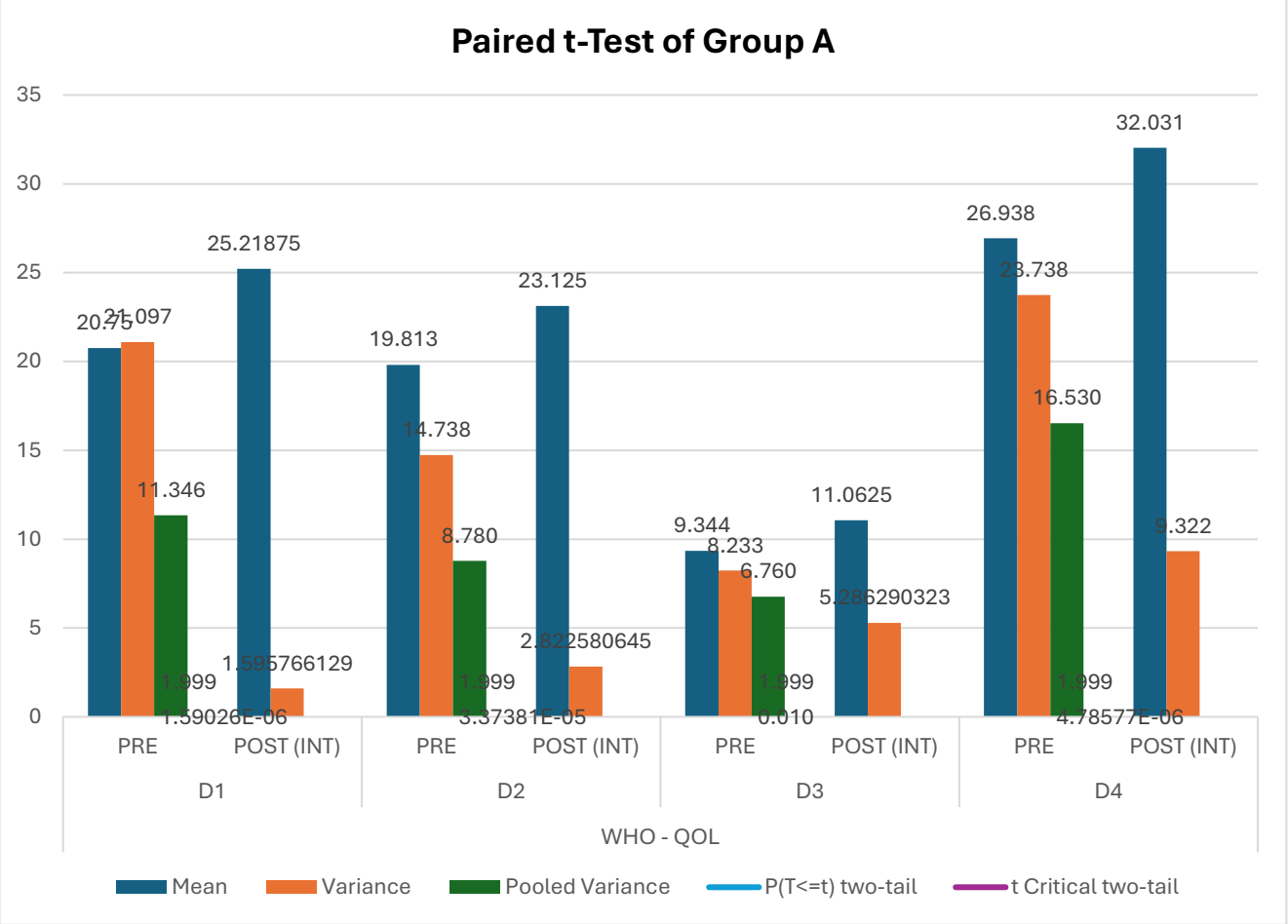

Table 4.0 Paired t-test of WHO-QOL for Group B

Group B - Control Group								
Stats	**WHO – QOL**							
	D1		**D2**		**D3**		**D4**	
	PRE	***POST (INT)***	***PRE***	***POST (INT)***	***PRE***	***POST (INT)***	***PRE***	***POST (INT)***
Mean	17.9375	21.1875	14.125	17.8125	8.46875	9.25	19.75	24.53125
Variance	1.544355	1.641129	3.596774	4.479839	3.934476	3.290323	4.83871	7.547379
Pooled Variance	1.592742		4.038306		3.612399		6.193044	
P(T<=t) two-tail	4.69E-15		5.54E-10		0.105199		1.39E-10	
t Critical two-tail	1.998972		1.998972		1.998972		1.998972	

Table 5.0 Comparison of Group A and Group B

Group A -Experimental Group										
Stats	**NDI**		**WHO – QOL**							
			D1	**D1**	**D2**	**D2**	**D3**	**D3**	**D4**	**D4**
	PRE	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**
Mean	19.774	13.419	20.677	25.258	19.677	23.129	9.258	11	26.871	32.032
Standard Error	1.236	0.659	0.835	0.227	0.687	0.307	0.516	0.415	0.887	0.557

Standard Deviation	6.883	3.668	4.650	1.264	3.824	1.708	2.875	2.309	4.938	3.104
Sample Variance	47.381	13.452	21.626	1.598	14.626	2.916	8.265	5.333	24.383	9.632
Group B-Control Group										
Stats	**NDI**		**WHO – QOL**							
			D1	**D1**	**D2**	**D2**	**D3**	**D3**	**D4**	**D4**
	PRE	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**	**PRE**	**POST (INT)**
Mean	29.258	23.677	17.968	21.097	14.065	17.645	8.484	9.226	19.710	24.290
Standard Error	0.608	0.567	0.225	0.214	0.341	0.346	0.362	0.330	0.399	0.436
Standard Deviation	3.386	3.156	1.251	1.193	1.896	1.924	2.014	1.839	2.224	2.425
Sample Variance	11.465	9.959	1.566	1.424	3.596	3.703	4.058	3.381	4.946	5.880

In comparing the two groups, Group A (Experimental) showed a significant improvement in pain, discomfort, and quality of life when compared to Group B (Control). For **pain**, measured using the (NDI), Group A experienced a notable reduction from a pre-intervention mean score of 19.774 to 13.419 post-intervention, indicating a decrease in pain. In contrast, Group B showed a lesser reduction in NDI, from 29.258 to 23.677. This suggests that Group A experienced a greater improvement in reducing pain compared to Group B.

Regarding **discomfort**, represented by the **physical health (D1) dimension** of the WHO-QOL, Group A improved from 20.677 pre-intervention to 25.258 post-intervention, while Group B showed a smaller improvement from 17.968 to 21.097. This indicates that Group A had a more substantial increase in physical health and reduction of discomfort.

In terms of **quality of life**, Group A also showed better improvements across the other WHO-QOL dimensions:

Psychological health (D2) improved from 19.677 to 23.129, whereas Group B improved from 14.065 to 17.645.

Social relations (D3) increased from 9.258 to 11.000 in Group A, compared to a smaller increase from 8.484 to 9.226 in Group B.

Environmental health (D4) in Group A rose from 26.871 to 32.032, while Group B increased from 19.710 to 24.290. Overall, Group A demonstrated more significant improvements in pain reduction, physical discomfort, and all dimensions of quality of life, suggesting that the intervention applied in this group was more effective than the control group's intervention.

DISCUSSION

The present study explores the effect of ergonomic intervention on neck pain, discomfort, and quality of life among female computer users.

This study was reviewed, discussed and approved through the Santosh Occupational Therapy Institutional Ethical Committee. It was, conducted in an American Express global business travel company in which the study design was a Randomised control trial and the sample size was 64. By using the Convenient sampling technique, the subjects were divided into two groups, the experimental group and the control group. The number of subjects in each group is 32. After data collection, the pre-intervention and post-intervention data are analysed and interpreted for statistical significance of intervention for the experimental and control groups. This study found that prolonged sitting in a particular position without interruptions to stretch the neck muscles is linked to neck pain among computer users. Teenagers who use computers for four to five hours every day are in danger of developing neck problems. Neck pain results from muscular imbalance caused by prolonged computer use, rounded shoulders, and poor neck posture, which alters the neck's natural lordotic curvature. The quality of life of the person will be impacted if the neck discomfort lasts longer and is not treated since it will weaken the neck extensors.

The results indicate significant enhancements in both the (NDI) scores and the World Health Organization Quality of Life (WHO-QOL) assessments, particularly in the domains of physical health, psychological health, social relations, and environmental factors.

Group A experienced a noteworthy reduction in NDI scores, with a pre-intervention mean of 19.774 dropping to 13.419 post-intervention. This substantial decrease highlights the intervention's success in alleviating neck pain and disability. The statistical analysis, evidenced by a p-value of 2.8E-05, further substantiates the effectiveness of the intervention. The reduction in variance from 47.38 to 13.45 indicates a more consistent

and reliable improvement among participants, reinforcing the intervention's impact on pain relief. In contrast, Group B, which served as the control group, demonstrated only modest improvements in NDI scores, decreasing from 29.258 to 23.677. While this reflects some level of improvement, it is significantly less than that observed in Group A, suggesting that the control group did not benefit from the same intensity or nature of intervention. The findings thus underscore the importance of the experimental intervention in achieving more pronounced benefits for Group A.

The WHO-QOL assessments further emphasize the intervention's effectiveness. Group A showed substantial gains across all domains, with physical health increasing from a mean of 20.677 to 25.258 and psychological health improving from 19.677 to 23.129. In particular, the environmental domain saw a remarkable enhancement from 26.871 to 32.032, indicating that the intervention not only alleviated pain but also contributed positively to participants' overall well-being. The statistical significance across these domains, demonstrated by p-values of 1.59E-06 for physical health and 3.37E-05 for psychological health, indicates that these improvements are unlikely to have occurred by chance. In comparison, Group B's improvements in the WHO-QOL assessments were less striking, with physical health increasing from 17.968 to 21.097 and psychological health from 14.065 to 17.645. The more pronounced changes in Group A suggest that the experimental intervention not only provided immediate pain relief but also enhanced participants' overall quality of life more effectively than the control condition. **Sneha Hiren Bhalala** conducted a study on the prevalence of neck pain in computer workers in Surat city: A cross-sectional study. From this study, it is concluded that 55 % of the people in the age group 20 to 50 years have mild and moderate neck pain. 39% of People can read as much as they want to with no pain in their neck. 39% of people have no headaches at all .39% of People can concentrate fully when they want to with no difficulty. 47% of People can do as much work as they want to. 36% of People can drive a car without neck pain. 53% of People have no trouble sleeping.[14] **Chandwani A, Chauhan M.K, and Bhatnagar** conducted a study on the ergonomics assessment of office desk workers working in corporate offices, the study aimed to examine the health-related problems faced by office employees due to workplace design and environmental conditions in modern offices. The findings highlighted that prolonged static posture, awkward sitting positions, improper chair design, suboptimal placement of keyboards, mouse and the absence of footrests were the most common contributors to musculoskeletal issues. While most employees rated the internal physical environment as satisfactory, many reported experiencing challenges with concentration and stress[15].

CONCLUSION

In conclusion, this study presents strong evidence supporting the effectiveness of the experimental intervention in managing neck pain and enhancing the quality of life among participants in the experimental group. The significant reductions in the (NDI) scores and the marked improvements in World Health Organization Quality of Life (WHO-QOL) assessments highlight the intervention’s success in alleviating pain and fostering overall well-being. The results indicate the experimental group experienced substantial improvements across various domains, particularly in physical and psychological health, which were significantly more pronounced compared to the modest gains observed in the control group. These findings not only underscore the efficacy of the intervention but also suggest valuable implications for clinical practice, advocating for the integration of similar approaches in managing neck pain. Overall, the study contributes important insights into effective pain management strategies and underscores the need for continued research in this area, paving the way for improved clinical outcomes for patients suffering from neck pain.

LIMITATIONS:

The study focuses only on female computer users, which was not representative of other populations (e.g., male computer users, non-computer users).

The study's ergonomic intervention was not tailored to individual participants' needs, which can limit its effectiveness.

FUTURE RECOMMENDATIONS

Future investigations with more diverse cohorts to validate these findings further. Additionally, exploring the long-term sustainability of the intervention’s effects will be crucial in establishing its lasting benefits.

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