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SCAPULAR DYSKINESIS AND WORK-RELATED PAIN IN OFFICE WORKERS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Office workers, particularly those working with computers for prolonged hours, were at high risk of developing scapular dyskinesia due to repetitive work and poor posture. Investigation was needed to determine how often scapular dyskinesia occurred in office workers, its association with pain, and the intensity of pain experienced.
Objective: The study aimed to determine the prevalence of scapular dyskinesia and examine its association with work-related pain among office workers.
Methodology: This cross-sectional study was conducted among office workers aged 20–50 years in Karachi, Pakistan, who worked at least 6 hours daily. Convenience sampling selected 140 participants (70 males, 70 females). The Lateral Scapular Slide Test (LSST) assessed scapular dyskinesia, and pain intensity was measured using the Visual Analog Scale (VAS). Data were analyzed using SPSS version 26. Chi-square tests evaluated associations, with significance at $p \leq 0.05$.
Results: Of 140 participants, 72 (51.43%) exhibited scapular asymmetry, while 68 (48.57%) had balanced scapulae. The age group 26–30 years had the highest scapular asymmetry prevalence (58.3%). Gender distribution of asymmetry was 52.7% males and 47.2% females. Pain levels showed 14 (10%) reported no pain, 85 (60.7%) mild pain, 37 (26.4%) moderate pain, and 4 (2.9%) severe pain. Moderate and severe pain were most common in the 26–30 age group (51.2%). Chi-square tests showed significant associations between scapular dyskinesia and work-related pain, except for age-pain intensity and gender-scapular stability relations.
Conclusion: Scapular dyskinesia was common among office workers and significantly associated with work-related pain. Early ergonomic interventions and physiotherapy could reduce scapular asymmetry and pain, improving office workers' health and productivity.

Introduction

Scapular dyskinesia explained the complex dysfunction of the shoulder blade and its critical role in shoulder pain and performance. Although it referred to irregular movement or positioning of the shoulder blade

during arm motions, which could result in shoulder pain and dysfunction. Office workers had a relatively high prevalence of SD, and those with apparent SD were more likely to experience neck and shoulder pain. Previous research showed that 90% of office workers experienced SD pain and discomfort in the scapular region. The majority of these studies—33%—were carried out in the US, and 17% in Europe. In India, the prevalence was found to be 73% for SD. In China, the prevalence of scapular dyskinesia was 90.08%. Prevalence of scapular dyskinesia in Asia was 33%. Office workers in Karachi prevalence showed that 89.9% also reported higher levels of shoulder pain. The survey of gender showed that 78% of males and 22% of females were found positive for scapular dyskinesia. A non-specific response to various shoulder conditions, scapular dyskinesia was characterized as a shift in normal scapular kinematics. The neck, shoulders, and back were frequently affected by work-related pain in office workers, which was brought on by prolonged sitting, poor ergonomics, and repeated duties. Two SD displayed a number of signs and symptoms, such as aberrant scapular motion and a loss of control over scapular motions, including external rotation and retraction, which changed the timing and size of scapular rotations.

Pain or discomfort in the region of the shoulder could be made worse by certain motions or activities. Shoulder stability and function were impacted by decreased strength in the rotator cuff and periscapular muscles. The shoulder's active range of motion was restricted, particularly while scapular motion was involved. Scapular positional referred to obvious irregularities in the scapula's resting position, such as coracoid discomfort and positional protrusion of the inferior medial border. In surgical intervention, there was no role for surgery in SD. Pharmacology only gave symptomatic relief. Physiotherapy was needed for pain and range of motion. Physiotherapy for scapular dyskinesia could restore proper scapular movement and improve function through scapular stabilization exercises, such as strengthening the serratus anterior and trapezius, postural correction to correct alignment issues, neuromuscular re-education to enhance motor control and movement coordination, stretching, and manual therapy to release tight muscles. Hence, this research aimed to show the scapular dyskinesia pain in office workers. Scapular dyskinesia (SD) was when the shoulder blade moved abnormally, which could cause shoulder and neck pain. Many office workers spent long hours sitting at desks, often leading to poor posture and repetitive movements, which may have increased the risk of SD. Although SD was well-known in athletes, there was limited research on how common it was and how it affected office workers.

This lack of understanding could result in ongoing pain, decreased work productivity, and lower quality of life for office workers. This study aimed to explore how often scapular dyskinesia occurred in office workers and how it was linked to pain, with the goal of improving office work environments and health practices.

Significant of Research

This study was important because it focused on scapular dyskinesia (SD), a condition causing shoulder pain which was common among office workers. Office workers often sat for long periods, used poor posture, and performed repetitive tasks, which could lead to SD. Understanding how SD affected workers could help improve work environments by making them more comfortable and reducing pain. This could have led to healthier workers, less pain, and better productivity.

Rationale

In Pakistan, many office workers spent long hours sitting at desks, which could lead to poor posture and repetitive movements. This could cause scapular dyskinesia (SD), a condition where the shoulder blade moved abnormally and led to pain in the shoulder region. Although this problem was common, it was not well-studied in Pakistan. Understanding how often SD occurred in office workers and its impact on their health was important. This research could help identify the causes of SD and suggest ways to improve workplace setups, reduce pain, and make office workers more comfortable and productive.

Research question

Is there an association between scapular dyskinesia and work- related shoulder or upper back pain among office workers?

Operational Definition:

Office Worker: An office worker was defined as an individual who worked primarily in an office setting, typically performing desk- based tasks such as typing, using a computer, or attending meetings for at least 4 hours a day.

Pain: Pain was measured using a standard pain scale, such as the Visual Analog Scale (VAS), where participants rated their pain from 0 (no pain) to 10 (worst pain possible) in their neck and shoulders.
Lateral Scapular Slide Test (LSST): It is a physical test that was used to check if the scapulae are moving or positioned unevenly. It helps identify muscle imbalances or problems that might cause shoulder pain or dysfunction.
Vernier caliper: A Vernier Caliper was a tool used to measure the length, inner and outer diameter, or depth of an object accurately.

Literature Review

Depreli et al. (2016) aimed to identify the prevalence of scapular dyskinesia among office workers. Using a cross- sectional study design, they assessed scapular movement patterns in office workers with musculoskeletal pain. Results showed a significant correlation between scapular dyskinesia and upper limb discomfort. However, the study was limited by its small sample size, reducing its generalizability.[14]

Moon and Kim (2023) investigated the relationship between computer use and scapular dyskinesia. They conducted an observational study measuring posture and pain levels among office workers. Their findings indicated that prolonged screen exposure and improper sitting postures exacerbated scapular dysfunction and neck pain. The study lacked a control group, making it difficult to establish causation.[15]

Vongsirinavarat and Wangbunkhong (2021) conducted a prevalence study on scapular dyskinesia in workers with neck and scapular complaints. Using clinical assessments, they found that muscle tightness and prolonged static postures contributed significantly to scapular dyskinesia. A limitation was the subjective nature of pain assessment, which may have introduced bias.[16]

Ain QU et al. (2021) examined the frequency of scapular dyskinesia and its relationship with static postures. Their survey-based study revealed that office workers performing repetitive arm movements had a higher incidence of scapular dysfunction. The study relied on self-reported data, which could affect accuracy.[17]

Kim et al. (2021) explored chronic pain associated with scapular dyskinesia. They used electromyography (EMG) to measure muscle imbalances and found that improper biomechanics led to increased strain on shoulder muscles. While their methodology provided objective muscle activity data, their sample was limited to a specific workplace

environmentaged 20–65 years. A lateral scapular slide test (LSST) was used to evaluate scapular dyskinesia, and the quick exposure check (QEC) method was used to analyze the ergonomic risk level. The results indicate that patients with scapular dyskinesia have a high ergonomic risk level.19

This study evaluates the effectiveness of modified robbery exercises supplemented with electromyography (EMG) biofeedback on muscle activation patterns and functional outcomes in individuals with scapular dyskinesia. A randomized controlled trial was conducted with 40 participants (20 in the control group receiving modified robbery exercises and ergonomic training, and 20 in the experimental group receiving modified robbery exercises with EMG biofeedback). The results showed that Modified robbery exercises with EMG biofeedback are more effective than traditional exercises alone in improving muscle activation, reducing functional disability, and enhancing the quality of life in individuals with scapular dyskinesia.20

Soliman et al. (2023) assessed the effectiveness of physiotherapy interventions for scapular dyskinesia. Their study concluded that targeted scapular muscle training improved scapular mobility and reduced pain. The limitation was the short intervention period, making long- term benefits unclear.21

This study aims to focus on to compare effectiveness of manual therapy v/s conscious control of scapula along with conventional physiotherapy to correct scapular dyskinesia in postsurgical cancer patients. A randomized controlled trial was performed, Forty patients were randomly allocated with oral cancer surgery into the two groups, Group A -Manual therapy along with conventional physiotherapy; Group B Scapular-focused exercises along with conventional physiotherapy was performed on both groups after neck dissection surgery for 3 months Post-surgical cancer

patients with scapular dyskinesia manual therapy along with conventional physiotherapy have promising effect. Manual therapy with conventional physiotherapy showed a significant improvement in shoulder AROM pain, QOL, improvement in strength and muscle activation pattern of lower trapezius and serrates anterior muscle.22

The aim of this study is to evaluate a new specific exercise program to restore normal position. The visual-analog scale, Quick DASH score, SICK scapula rating scale, hand press- up position test, lateral scapular

slide test and internal rotation of the shoulder were evaluated. Scapula- focused exercise programs, as well as massage therapy, can effectively relieve pain in patients with SD. However, scapula-focused exercises resulted, specifically, in greater improvement of shoulder function.23

METHODOLOGY:

STUDY DESIGN

The studydesign was cross-sectional

STUDY SETTING

The study was conducted among the office workers of Karachi, Pakistan

STUDY POPULATION:

The population for this Cross-Sectional study consists of adults (male and female), who are office workers.

INCLUSION CRITERIA

- Ages between 20 to 50
- Workingat least 1 year
- Working at least 6 hours per day

EXCLUSION CRITERIA

- Having a surgical operation on related upper extremities
- Recent fracture of humerus
- Having structural scoliosis, neurological, or systemic diseases

DATA COLLECTION PROCESS:

Data was collected through primary tools (LSST, VAS) , LSST helped to assessed scapular dyskinesia , we took three ranges from lsst scale , first we took ranges in neutral position of arm , second we took 90 abduction , and third arm of wrist on pelvic Study that is Cross-Sectional in nature was conducted in office workers of Karachi, Pakistan. People who suffer from shoulder and neck pain are included in this study. Physical assessment, LSST, and vernier caliper was used on all the participants. The motive and procedures of the study will be thoroughly explained to the subjective. Data was collected by using vas scale and the lateral scapular slide test.

OUT COME MEASURE

For evaluation VAS and LSST was use.

DATAANALYSIS:

The data was analyzed by using statistical techniques such as chi-square tests and data was entered in and analyzed by SPSS version 26.

4 1. Result

This chapter discusses the results of statistical applications on dependent variables, independent variables, and their mutual relations. It reviews two aspects of data analysis i.e. (i) Data dissection and its visualization aiming to provide research glimpse briefly to general audience and (ii) Statistical descriptions including descriptive statistics, correlation & chi-square analysis, and diagnostic analysis.

This chapter of results & discussion contains seven sections; First section is introduction which discusses the objective of chapter. The second section is data visualization of all data sets. Third Section is descriptive statistical details of dependent variables with independent variables. The fourth section is correlation matrix of data which stated and discussed the inter-relation of variables. Fifth Section contains chi-square analysis which compares the actual and expected results leading to accept or reject null hypothesis. Sixth section is the discussion of diagnostic Analysis which attempted to ascertain that either all verification checks be maintained during that statistical tools' application or not. It includes reliability test, normality test, homogeneity test and multicollinearity test. Reliability test aims to identify the internal consistency of questionnaires, normality test aiming to find the symmetry or normality of responses. And homogeneity test Filiz Ozdemir (2020) in his cross-sectional study included office workers aiming to vet that all chosen samples have had familiar characteristics. Moreover, multicollinearity aims to identify the situation in

which two or more explanatory variables in a model are highly linearly related. The seventh section is summary which discusses the decision acceptance and rejection of hypothesis and overall

Data Visualization

Chart 1: Age-wise population: Showing break-up of population w.r.t. age brackets of respondents.

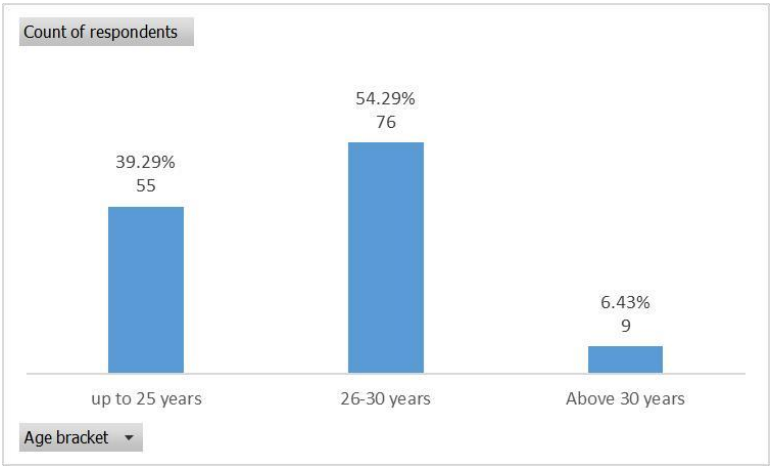


Chart-01 showing that one-hundred and forty respondents have examine for research consist with three (03) age-brackets i.e., 55 respondents (39.29% of population) having age bracket of up to 25 years old, 76 respondents (54.29% of population) having age bracket of 26-30 years old and 09 respondents (6.43% of population) having age bracket of above 30 years old.

Chart 2: Count of gender-wise Population: Showing break-up of population of respondents w.r.t. gender-wise population.

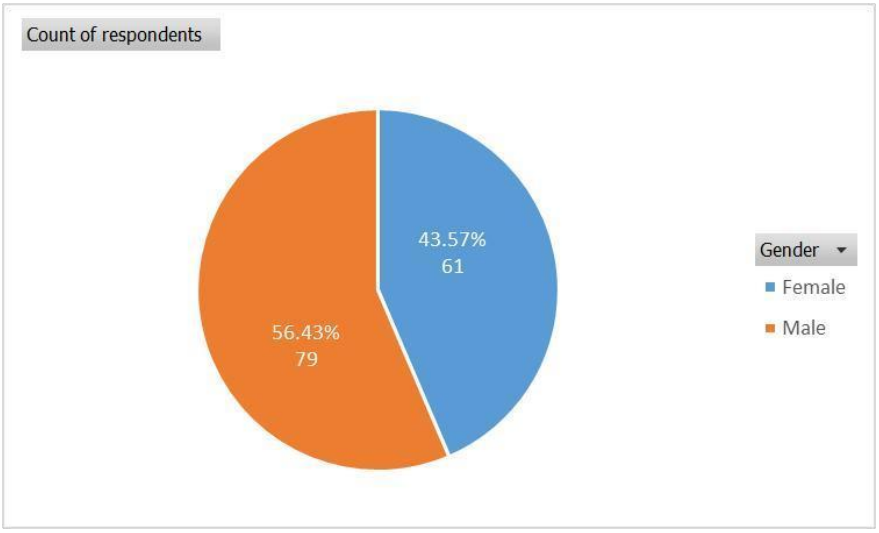


Chart-2 showing that One-hundred and forty respondents have examine for research consist with two (02) genders i.e., 70 respondents (50.0% of population) are male, and 70 respondents (50.0% of population) are female.

Descriptive Statistics

Table 1: Descriptive Analysis of Independent-variables Scale:

DV Elements	N	Min.	Max.	Mean	SD	Variance	%
Age	140	22	35	27	.593	.352	77.1% xvi

Gender	140	1	2	2	.502	.252	75.0%

Above table showing descriptive analysis of dependent variables related to Association between scapular dyskinesia and work-related pain in office workers showing that each element showing how frequently respondents made assertive answers against these questions; results showing that respondents have highest age is 35, lowest age is 22 within average of 27.

Table 2: Descriptive Analysis of LSST Scale:

LSST	N	Min.	Max.	Mean	SD	Variance	%
Arm at rest	140	0	12	0.79	1.462	2.137	6.6%
Hands on hip	140	0	5	0.78	.836	.699	17.4%
Arms abducted to 90 degrees	140	0	4	0.75	.845	.714	21.3%

Above table shows descriptive analysis of LSST related to Association between scapular dyskinesia and work-related pain in office workers; study of each element showing how frequently respondents made assertive answers against these questions. LSST is the parameters to show the overall involvement of respondents in response to assess the Association between scapular dyskinesia and work-related pain in office workers here and in the rest of documents as well; showing that 21.3% respondents have highest response for item "Arms abducted to 90 degrees" and 6.6% respondents have lowest response for item "arm at rest".

Correlation Matrix

Correlation is a statistical technique that ascertains whether and how strongly set of variables are related. In this research, correlation coefficient computed from the
sample data measures the strength and direction (positive or negative) of a linear relationship between dependent and independent variables. If the value of the correlation coefficient is significant among the variable (s), we would have to go to evaluate the level of parity between the actual and expected results through Chi- square.

Table 3: Correlation Analysis of LSST prevalence-work prevention:

LSST	Arm at rest	Hands on hip	Arms abducted to 90 Degrees	Scapular stability & symmetry
Arm at rest	1.00	0.12	0.06	0.29
Hands on hip	0.12	1.00	-0.11	0.40
Arms abducted to 90 degrees	0.06	-0.11	1.00	0.55
Scapular stability & symmetry	0.29	0.40	0.55	1.00

Above table is Correlation Analysis of LSST assessment of prevalence of pain shows the correlation between items of LSST prevalence of our research data. Directions of relations among has positive and negative impact for Association between scapular dyskinesia and work-related pain in office workers. Results showing that "Arms abducted to 90 degrees" have highest positive relationship to
i.e. 55.0%, and the least relationship has found positive impact of item "Arm at rest"
i.e. 29.0% is correlated positively with Scapular stability & symmetry.

Table 4: Case Processing Summary:

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Scapular stability & symmetry	139	100%	0	0%	139	100%
Age * Pain Intensity	139	100%	0	0%	139	100%
Gender * Scapular stability & symmetry	139	100%	0	0%	139	100%

Gender * Pain Intensity	139	100%	0	0%	139	100%

Above table showing that each element has greater chi-square value than of p- value; resulting that each HO has rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Association between scapular dyskinesia and work-related pain in office workers except relationship of "age and pain intensity" and relation of "Gender and Scapula

Diagnostic Analysis

Diagnostic analyses in research are to be performed to check that all conditions for application of statistical analysis have verified or not with a substantial degree of accuracy. In this research we have checked (i) reliability and (ii) multicollinearity of all independent variables.

Reliability:

Reliability of a questionnaire as a survey instrument ensures the accuracy of measures by assessing its internal consistency. There are different methods available to evaluate the internal consistency of the questionnaire. As we used SPSS, Cronbach alpha was used to assess reliability. Cronbach's alpha is a measure of internal consistency, which describes how closely related a set of items are as a group. It is a measure of scale reliability having a statistical standard that Cronbach's alpha of 0.70 and up 0.79 has acceptable internal consistency, 0.80 and up to 0.89 is good and 0.90 and above considered as excellent internal consistency.

Table 6: Case Processing Summary:

		N	%
Cases	Valid	140	100
	Excluded a	0	0
	Total	140	100

Above table shows that each element has no exclusion, and each element has assessed with filled parameters.

Table 7: Reliability Statistics:

Cronbach's Alpha	Cronbach's Alpha	N of sub- scales
LSST	0.111	3
LSST +	0.231	4

VAS

Above table shows that Cronbach's Alpha of two (02) scale; LSST questionnaire is 0.111 with three (03) items which is poor reliability of LSST questionnaire to use this in this research. Similarly, Inclusion of VAS with LSST questionnaire is 0.231 with one (01) item which is also poor reliability of showing that both questionnaire have poor reliability to use this in this research.

Multicollinearity: In statistical research, Multicollinearity is known as a situation in which two or more explanatory variables in a model are highly linearly related. Multicollinearity is denoted by variance inflation factor (VIF). If VIF is greater than ten, there is severe collinearity in that specific variable and research results would perturb. In contrast If VIF is less than 10, there is no collinearity, and data is acceptable for performing the statistical analyses.

Table-8: Multicollinearity Values:

Model: Dependent Variable: LSST & VAS	
Age	1.001
Gen der	1.001
a. Dependent Variable: Prevalence of Scapular asymmetry and Pain	

Above table shows that VIF of all two (02) components are <10 which shows there is no collinearity and data

is acceptable for performing the statistical analyses.

Normality Test: Normality Test determines whether sample data has been drawnfrom a normallydistributed population. Here we are using the Shapiro-Wilk. Test to assess the normality; where value of the Shapiro-Wilk test is greater than 0.05, it assumes the data is normal.

Table-9: Normality tests of prevalence Scapular asymmetry:

		Shapiro-Wilk		
Prevalence of Scapular asymmetry		Statistic	Sig.	Remarks
Age	Up to 25 years	0.636	0.000	
	26-30 years	0.632	0.000	
	Above 30 years	0.655	0.000	
Gender	Male	0.634	0.000	
	Female	0.636	0.000	

Above table shows that each dimension of prevalence of Scapular asymmetry has derived from a normal distributed population for assessment of all factors have significant impact on Association between scapular dyskinesia and work- related pain in office workers as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments.

Table-10: Normality tests of prevalence of pain:

		Shapiro-Wilk		
Prevalence of pain		Statistic	Sig.	Remarks
Age	Up to 25 years	0.816	0.000	
	26-30 years	0.782	0.000	
	Above 30 Years	0.813	0.028	
Gender	Male	0.792	0.000	
	Female	0.801	0.000	

Above table shows that each dimension of prevalence of pain risk prevalence has derived from a normal distributed population for assessment of all factors have significant impact on Association between scapular dyskinesia and work-related pain in office workers as value of the Shapiro-Wilk test is greater than 0.05 for all **Homogeneity Test** In the test of homogeneity, we select random samples from each subgroup or population separately and collect data on a single categorical variable.

Table 10: Homogeneity Test:

		Levene		
		Statistic	Sig.	Remarks
Age	Prevalence of Scapular asymmetry	0.14	0.87	
	Prevalence of pain	0.30	0.74	
Gender	Prevalence of Scapular asymmetry	0.36	0.55	
	Prevalence of pain	0.57	0.45	

Above table shows that population of all elements for assessment of all factors have significant impact on Association between scapular dyskinesia and work-related pain in office workers Here for; p-value is more than 0.05 in all elements hence homogeneity assumption of the variance is met; have a mean that spread of data within each combination of factors should be roughly the same.

Discussion of Results

This chapter presented a detailed discussion about the statistical tests performed in this research to assess the developed hypotheses that based on how extensively Assertiveness to Association between scapular dyskinesia and work-related pain in office workers as dependent variable are influenced by a set of

independent variables This research has assessed with LSST aiming to make this research as multi-dimensional assessment of deep insight of reasons of assertiveness to Association between scapular dyskinesia and work-related pain in office workers. In the first section, a brief introduction of this chapter presents which analyses to be performed and later-on be discussed. Organization of sections of chapter is also discussed here in this section. In the second section, data visualization has presented all factors.

In the third section, descriptive statistics analyze dependent and independent variables. It includes some basic descriptive statistical tools i.e., count of observations, range, mean, maximum value, minimum value, and percentiles of assertiveness to Association between scapular dyskinesia and work-related pain in office workers Results showing how frequently respondents made assertive answers against these questions that respondents have Association between scapular dyskinesia and work-related pain in office workers results showing that respondents have highest age is 35, lowest age is 22 within average of 27.. It is also revealed that 21.3% respondents have highest response for item "Arms abducted to 90 degrees" and 6.6% respondents have lowest response for item "arm at rest".. In the fourth section, Correlation Analysis shows the correlations between scales on prevalence with positive and negative impact to Association between scapula abducted to 90 degrees" have highest positive relationship to i.e. 55.0%, and the least relationship has found positive impact of item "Arm at rest" i.e. 29.0% is correlated positively with Scapular stability & symmetry.

In the fifth section, Chi-square test has performed which compares the actual and expected results leading to reject null hypothesis. Results showing that each element has greater chi-square value than of p-value; table showing that each element has greater chi-square value than of p-value; resulting that each HO has rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Association between scapular dyskinesia and work- related pain in office workers except relationship of "age and pain intensity" and relation of "Gender and Scapular stability & symmetry".

In the sixth section, diagnostic analysis has performed including reliability, multicollinearity normality and homogeneity.

Reliability Above table shows that Cronbach's Alpha of two (02) scale; LSST questionnaire is 0.111 with three (03) items which is poor reliability of LSST questionnaire to use this in this research. Similarly, Inclusion of VAS with LSST questionnaire is 0.231 with one (01) item which is also poor reliability of showing that both questionnaire have poor reliability to use this in this research.

Multicollinearity is denoted by variance inflation factor (VIF). Results show that VIF of all two (02) components are <10 which shows there is no collinearity and data is acceptable for performing statistical analyses. Normality Test determines whether sample data has been drawn from a normally distributed population. Here we are using the Shapiro-Wilk Test and Above table shows that each dimension of prevalence of Scapular asymmetry has derived from as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments. Similarly, another results shows that each dimension of prevalence of Scapular asymmetry has derived from a normal distributed population for assessment of all factors have significant impact on Association between scapular dyskinesia and work-related pain in office workers as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments.

Test of homogeneity denotes by Levene's test and select random samples from each subgroup or population separately and collect data on a single categorical variable. Results Above table shows that population of all elements for assessment of all factors have significant impact on Association between scapular dyskinesia and work-related pain in office workers Here for; p-value is more than 0.05 in all elements hence homogeneity assumption of the variance is met; have a mean that spread of data within each combination of factors should be roughly the same

Prevalence of Scapular asymmetry-LSST based:

Based on collected data, below are the deep insights for entire research. Showing break-up of population w.r.t. prevalence of scapular asymmetry among respondents.

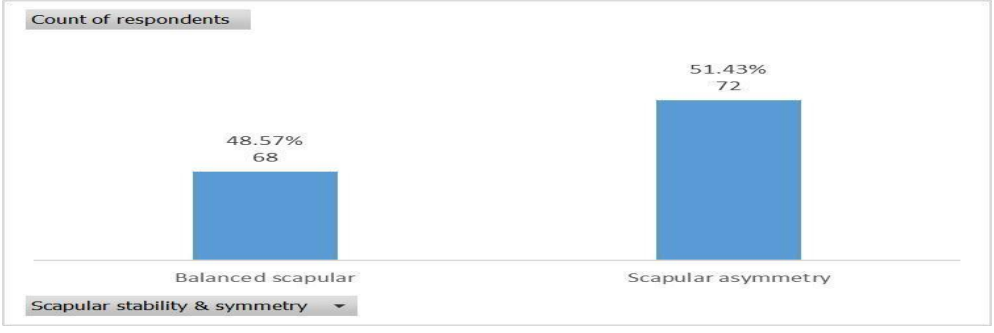


Chart showing that one-hundred and forty respondents have examine for research consist with two (02) states of prevalence of scapular asymmetry according to LSST i.e., 68 respondents (48.57% of population) have balanced scapular and 72 respondents (51.43% of population) have scapular asymmetry.

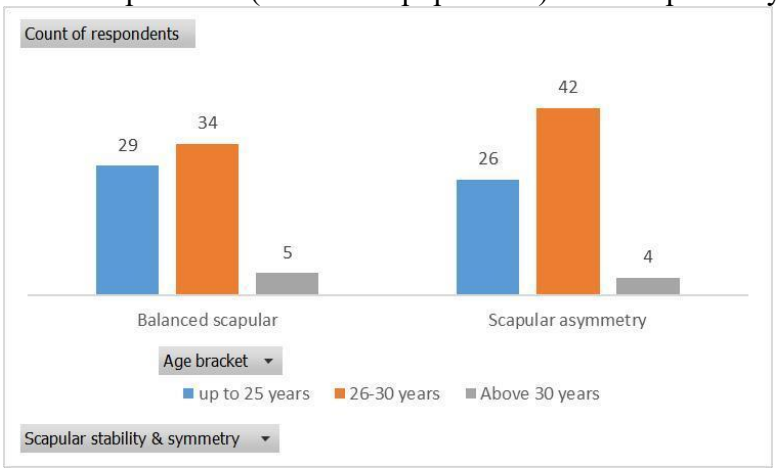
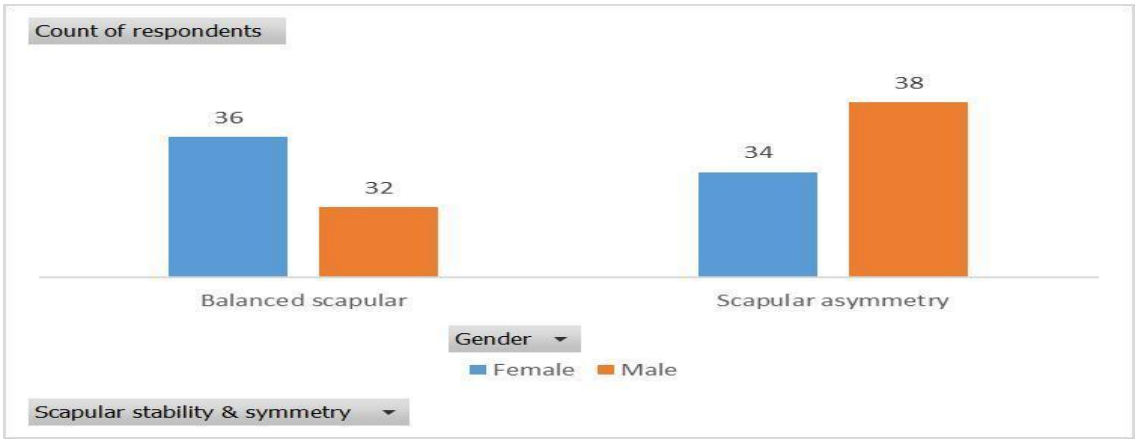


Chart showing that one-hundred and forty respondents have examine for research
consist with two (02) states of prevalence of scapular asymmetry according to LSST with three (03) age bracket i.e., highest count of respondents having high- scapular asymmetry is 42 respondents (58.3% of asymmetry-population) have age of above 26-30 years and lowest count of respondents having high-scapular asymmetry is 04 respondents (5.5% of asymmetry-population) have age of above 30 years.



A normal distributed population for assessment of all factors have significant impact on Association between scapular dyskinesia and work related pain in office workers

Chart showing that one-hundred and forty respondents have examine for research consist with two (02) states of prevalence of scapular asymmetry according to LSST with two (02) genders i.e., highest count of respondents having high-scapular asymmetry is 38 respondents (52.7% of asymmetry-population) are males and lowest count of respondents having high-scapular asymmetry is 34 respondents (47.2% of asymmetry-population) are female.

Prevalence of Pain-VAS based:

Based on collected data, below are the deep insights for entire research. Showing break-up of population w.r.t. prevalence of pain among respondents.

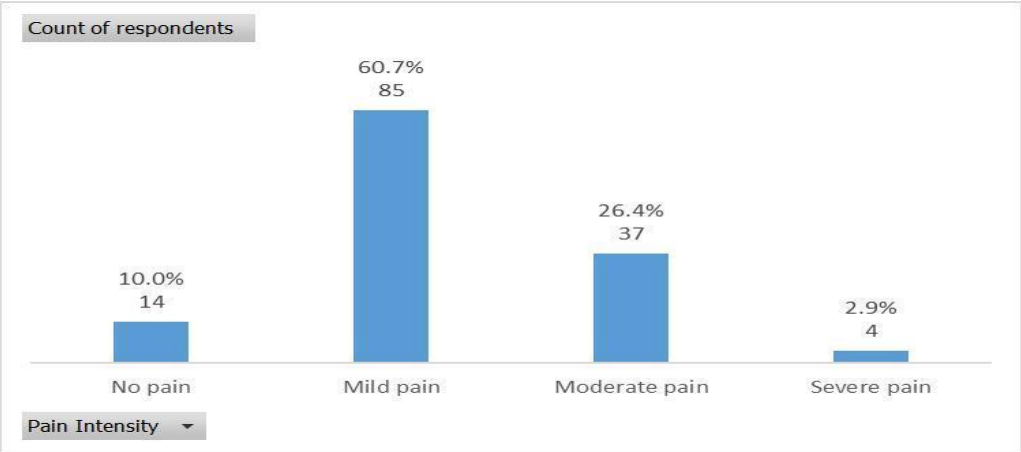


Chart showing that one-hundred and forty respondents have examine for research consist with four (04) states of prevalence of pain according to VAS i.e., 14 respondents (10.0% of population) have no-pain, 85 respondents (60.7% of population) have mild-pain, 37 respondents (26.4% of population) have moderate-pain and 04 respondents (2.9% of population) have severe-pain.

Chart showing that one-hundred and forty respondents have examine for research consist with four (04) states of prevalence of pain according to VAS with four (04) age bracket i.e., highest count of respondents having moderate and severe pain is 21 respondents (51.2% of moderate and severe-pain population) have age of above 26-30 years and lowest count of respondents having moderate and severe pain is 03 respondents (7.3% of moderate and severe-pain population) have age of above 30-years.

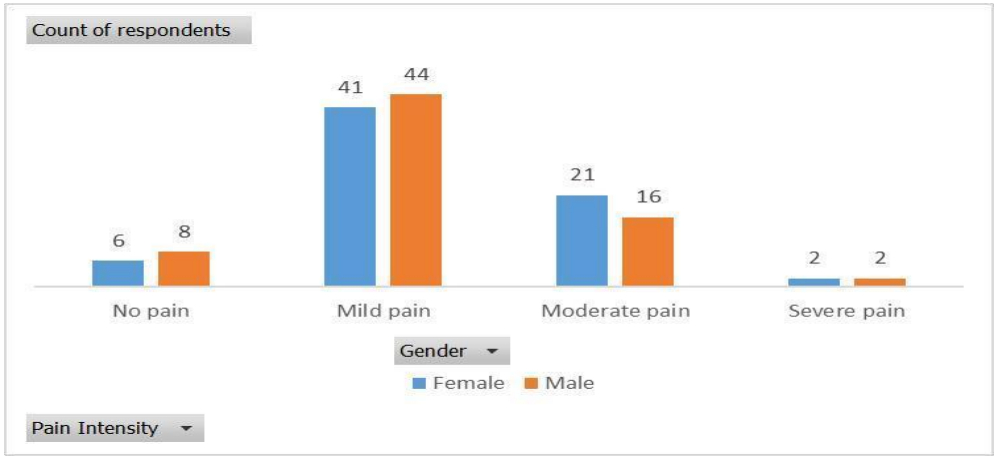


Chart showing that one-hundred and forty respondents have examine for research consist with two (02) states of prevalence of scapular asymmetry according to VAS with two (02) genders i.e., highest count of respondents having high-scapular asymmetry is 18 respondents (43.9% of moderate and severe-pain population) are female and lowest count of respondents having high-scapular asymmetry is 18 respondents (56.09% of moderate and severe-pain population) are male.

Table : 11- Cross tabulation of scapular asymmetry risk:

	Scapular stability & symmetry		Total
Age	Normal : Balanced scapular	Abnormal : Scapular asymmetry	
up to 25 years	29	26	55
26-30 years	34	42	76
Above 30 years	5	4	9
Total	68	72	140
The above table shows that age group of "26-30" exists with highest numbers i.e. 42 (30.00%) and "Above 30 years" with minimum number of 04 (2.86%) of total population of "scapular asymmetry" status cross-tabulated over LSST- based assessment of scapular stability & symmetry.			
	Scapular stability & symmetry		Total
Gender	Normal : Balanced scapular	Abnormal : Scapular asymmetry	
Male	32	38	70
Female	36	34	70
Total	68	72	140
The above table shows that gender group of "Male" exists with highest numbers i.e. 38 (27.14%) and "Female" with minimum number of 34 (24.29%) of total population of "scapular asymmetry" status cross-tabulated over LSST- based assessment of scapular stability & symmetry.			

Table : 11- Cross tabulation of pain prevalence:

	Pain Intensity				Total
Age	No pain	Mild pain	Moderate pain	Severe pain	
up to 25 years	6	32	15	2	55
26-30 years	7	48	19	2	76
Above 30 years	1	5	3	0	9
Total	14	85	37	4	140
The above table shows that age group of "26-30" exists with highest numbers i.e. 21 (15.00%) and "Above 30 years" with minimum number of 03 (2.14%) of total population of "moderate and severe pain" status cross-tabulated over VAS-based assessment of pain-severity.					

	Pain Intensity				Total
Gender	No pain	Mild pain	Moderate pain	Severe pain	
Male	8	44	16	2	70
Female	6	41	21	2	70
Total	14	85	37	4	140
The above table shows that gender group of "female" exists with highest numbers i.e. 23 (16.43%) and "male" with minimum number of 18 (12.86%) of total population of "moderate and severe pain" status cross-tabulated over VAS- based assessment of pain-severity.					

DISCUSSION

sapular dyskinesia (SD) refers to abnormal movement or positioning of the shoulder blade during arm motions, often resulting in shoulder and neck pain. It significantly impacts shoulder performance, particularly in office workers who are prone to musculoskeletal issues due to prolonged sitting, poor posture, and repetitive tasks. Research indicates a high prevalence of SD among office workers, with reported rates as high as 90% in China and 89.9% in Karachi. Similarly, studies from India found a 73% prevalence, and overall, 33% of SD studies were conducted in the U.S. and 17% in Europe. In Karachi-based studies, males showed a 78% prevalence, compared to 22% in females. SD is characterized by altered scapular kinematics, such as abnormal scapular motion, loss of external rotation and retraction control, and visible malposition like coracoid tenderness or medial border protrusion. These issues are linked to reduced rotator cuff and periscapular muscle strength, limiting the shoulder's active range of motion and stability. Surgical interventions are not typically recommended for SD. Pharmacological treatment offers only temporary symptomatic relief. The preferred treatment is physiotherapy, which includes scapular stabilization exercises (targeting serratus anterior and trapezius), postural correction, neuromuscular re-education, stretching, and manual therapy. This research emphasizes the need for greater awareness and intervention strategies to manage SD among office workers. Improving ergonomics and incorporating preventive physiotherapy can reduce pain, enhance productivity, and improve the quality of life for affected individuals. The study highlights the critical importance of addressing scapular dyskinesia in sedentary work environments.

5.1. Summary

The study involved 140 respondents categorized into three age brackets: 55 (39.29%) were up to 25 years old, 76 (54.29%) between 26–30 years, and 9 (6.43%) above 30 years. Gender distribution was equal, with 70 males and 70 females. The prevalence of scapular asymmetry was measured using the Lateral Scapular Slide Test (LSST), showing that 72 participants (51.43%) had scapular asymmetry, while 68 (48.57%) had balanced scapulae. When examining scapular asymmetry by age, the 26–30 years group showed the highest prevalence (58.3%) among those with asymmetry, while only 5.5% of asymmetry cases were in those over 30 years. Gender-wise, scapular asymmetry was slightly more prevalent among male (52.7%) compared to females (47.2%). Pain levels were assessed using the Visual Analogue Scale (VAS). Among the respondents, 14 (10%) reported no pain, 85 (60.7%) had mild pain, 37 (26.4%) experienced moderate pain, and 4 (2.9%) reported severe pain. Age-wise, moderate to severe pain was most common among those aged 26–30 years (51.2%) and least common in those over 30 years (7.3%). Further analysis of scapular asymmetry among those with moderate to severe pain revealed a slightly higher prevalence in males (56.09%) compared to females (43.9%). In summary, scapular asymmetry and related pain are most prevalent among individuals aged 26–30, with males showing slightly higher rates. These findings highlight the need for early ergonomic and physiotherapeutic interventions in this age group to reduce asymmetry and manage pain effectively.

Interpretation:

This research presents a comprehensive analysis of statistical tests conducted to examine the assertiveness related to the association between scapular dyskinesis and work-related pain in office workers. Using the **Lateral Scapular Slide Test**

(LSST), the research assessed how a range of independent variables influence this association, aiming for a multi-dimensional understanding. The first section introduces the analysis approach and the chapter structure. Research uses data visualizations to represent various measured factors. Moreover, descriptive statistics summarize the dataset, showing the age range of participants (22–35 years, average 27) and response patterns. The highest assertive response (21.3%) was recorded for the item "Arms abducted to 90 degrees," while "Arm at rest" received the lowest (6.6%). Later on, discusses correlation analysis. "Arms abducted to

90 degrees" showed the highest positive correlation (55%) with scapular stability, while "Arm at rest" had the weakest (29%). Research reports chi- square test outcomes, indicating statistically significant relationships for most variables, except for "age and pain intensity" and "gender and scapular stability," leading to the rejection of most null hypotheses. Analysis includes diagnostic testing. Reliability analysis showed poor internal consistency for both LSST (Cronbach's alpha = 0.111) and VAS (0.231). However, multicollinearity was not a concern (VIF <10). Normality was confirmed via the Shapiro-Wilk test ($p > 0.05$), and Levene's test supported homogeneity of variance ($p > 0.05$). Overall, the chapter validates significant associations between scapular dyskinesis and work-related pain, despite low reliability of the tools used.

Implication

This research is significant as it addresses scapular dyskinesia (SD), a musculoskeletal condition prevalent among office workers due to prolonged sitting, poor posture, and repetitive upper body movements. These workplace conditions often lead to shoulder instability and pain, directly impacting workers' comfort, productivity, and overall well-being. The study provides valuable insights into the association between SD and work-related pain, emphasizing the role of assertiveness in identifying and reporting discomfort related to scapular instability. By utilizing statistical tools such as LSST and VAS, the research explores how SD varies across different age groups and genders, and how it correlates with varying levels of pain. The findings highlight a strong association between certain scapular movements (e.g., arms abducted to 90 degrees) and scapular instability. This deep analysis not only confirms that scapular asymmetry and pain are significant problems in office environments but also underscores the importance of early detection and intervention. The study also demonstrates how assertiveness in self- reporting pain and dysfunction can play a key role in identifying SD-related issues. Importantly, it recommends non-surgical interventions like physiotherapy and ergonomic corrections as effective strategies for managing SD. Overall, the research contributes to occupational health by encouraging organizations to implement preventive measures such as ergonomic assessments, physical activity breaks, and workplace awareness programs. Such actions can significantly reduce the risk of SD, enhance employee health, minimize absenteeism, and improve job performance, making this study highly relevant for public health and workplace wellnessstrategies

Limitations:

While the proposed research model provides a structured approach to investigating scapular dyskinesia (SD) and work-related pain among office workers, several limitations are evident that may affect the generalization and depth of the findings. Firstly, the cross-sectional study design limits the ability to establish causality. It can only capture a snapshot of the relationship between SD and pain at one point in time, without determining whether scapular dyskinesia causes work-related pain or vice versa. A longitudinal study would be more effective in establishing cause- and-effect relationships. Secondly, geographic limitation to Karachi restricts the findings' applicability to other regions or populations with different work environments, ergonomic practices, and socioeconomic conditions. This affects the external validity of the research. Thirdly, the exclusion criteria—particularly the removal of individuals with high BMI (>39), prior surgeries, recent physiotherapy, or systemic conditions—may lead to a biased sample. Many office workers may have commodities or be overweight and excluding them narrows the real-world applicability of the results. Fourthly, the reliability of tools like LSST and VAS may pose a limitation, especially given earlier findings indicating low Cronbach's alpha values (poor internal consistency). This questions the precision and reproducibility of the assessments. Lastly, the subjective nature of pain reporting and physical assessment may introduce observer and respondent bias. Additionally, no psychological or occupational stress measures are considered, despite their known influence on musculoskeletal symptoms. Overall, these methodological limitations suggest a need for improved study design, broader inclusion, and more robust assessment tools for future research.

Recommendations:

To enhance the validity, reliability, and applicability of the research on scapular dyskinesia (SD) and work-related pain among office workers, several improvements are recommended. Firstly, adopting a longitudinal study design would offer stronger evidence of causality between scapular dyskinesia and work- related pain. Tracking participants over time could reveal how posture-related dysfunctions develop and evolve, and whether interventions reduce symptoms. Secondly, expanding the geographic scope beyond Karachi would enhance external validity. Including diverse work settings across different cities or regions would account for variations in workplace ergonomics, stress levels, and job roles, providing a broader understanding of SD prevalence. Thirdly, revising the inclusion and exclusion criteria is necessary. Instead of excluding

individuals with high BMI or comorbidities, researchers could stratify the sample to analyze how such variables influence SD. This approach would make findings more reflective of real-world office worker populations. Fourth, using more reliable and validated tools is critical. Replacing or supplementing LSST and VAS with tools that demonstrate stronger internal consistency—such as 3D motion analysis or electromyography—can improve measurement accuracy. Additionally, inter-rater reliability testing should be included for physical assessments. Lastly, the study should integrate psychological and occupational stress measures, such as the Job Stress Scale or Beck Anxiety Inventory, since stress significantly impacts musculoskeletal conditions.

Conclusion

Scapular dyskinesia (SD), defined as abnormal movement or positioning of the scapula during arm motion, presents a significant concern in modern occupational health— particularly among office workers. This condition contributes to neck and shoulder pain and can impair upper limb function. The present research focused on investigating the prevalence, pain association, and related variables of SD in office workers, especially within the urban setting of Karachi. Given the sedentary nature of office jobs, which often involve prolonged sitting, poor posture, and repetitive hand and arm movements, this study holds relevance in addressing a pressing ergonomic issue. The high prevalence of scapular dyskinesia across various global studies reflects its growing recognition as a musculoskeletal disorder. In China, 90.08% of office workers were found to experience SD symptoms, while in Karachi, the prevalence was slightly lower at 89.9%. Other countries such as India and regions including the
U.S. and Europe also reported significant prevalence, emphasizing the widespread nature of the condition. Interestingly, the gender distribution in Karachi showed that males (78%) were more affected by SD than females (22%), potentially hinting at differences in work ergonomics, posture, or occupational roles. Physiologically, SD is characterized by alterations in scapular kinematics, such as restricted external rotation, retraction, and poor scapular control. These kinematic changes are typically associated with weakness in the rotator cuff and periscapular muscles. The resulting muscular imbalance not only affects shoulder range of motion but also leads to visible deformities such as coracoid tenderness and protrusion of the scapula's medial border. These symptoms can significantly disrupt daily activities and work performance. In terms of intervention, the findings confirmed that surgical treatment is not typically recommended for SD. Instead, physiotherapy has emerged as the most effective and sustainable approach. Evidence suggests that a combination of scapular stabilization exercises (especially targeting the serratus anterior and trapezius), postural correction, neuromuscular re-education, and manual therapy can restore scapular control and reduce pain. Such non-invasive methods offer both symptomatic relief and functional improvement, making them highly suitable for the office-working population.

The study examined 140 office workers divided into three age brackets: up to 25 years, 26–30 years, and above 30 years. The majority fell in the 26–30 years category
(54.29%), followed by up to 25 years (39.29%) and a small portion above 30 (6.43%).

Gender distribution was equal, with 70 males and 70 females. Scapular asymmetry was evaluated using the Lateral Scapular Slide Test (LSST). The results showed that 72
participants (51.43%) exhibited scapular asymmetry, while 68 (48.57%) had symmetrical scapular positioning. Notably, among those with asymmetry, the age group 26–30 years showed the highest incidence (58.3%), suggesting that this age group
may be most at risk due to peak career activity and prolonged work hours. Gender- wise, scapular asymmetry was slightly more prevalent in males (52.7%) than females (47.2%). Pain levels were measured using the Visual Analogue Scale (VAS). Most participants (60.7%) experienced mild pain, while 26.4% had moderate pain, 2.9% severe pain, and only 10% reported no pain. Pain severity was again most common in the 26–30 age group (51.2%), reinforcing the need for early intervention. Among those with moderate to severe pain, males had a higher representation (56.09%) than females (43.9%).

The statistical analysis in this research offers a multi-dimensional understanding of the association between SD and work-related pain. Descriptive statistics showed that the average age of participants was 27 years, with the oldest being 35 and the youngest 22. The data revealed that the highest assertive response ($21_{x \cdot x}3\%$) in the LSST came from the movement "arms abducted to 90 degrees," while the lowest (6.6%) was for "arm at rest." Correlation analysis supported these findings, showing a strong positive relationship (55%) between scapular instability and "arms abducted to 90 degrees." The weakest correlation (29%) was observed for "arm at rest." These results suggest that dynamic arm movements are more effective in detecting scapular instability than static postures. The chi-square test results reinforced the significant associations among most

variables. However, exceptions were found in the relationships between “age and pain intensity” and “gender and scapular stability,” where no statistical significance was observed. Most null hypotheses were rejected, confirming the relevance of the independent variables studied. Reliability analysis of the LSST and VAS tools showed low Cronbach’s alpha values (0.111 and 0.231, respectively), indicating poor internal consistency. Despite this, the diagnostic testing for multicollinearity (VIF <10), normality (Shapiro-Wilk test $p > 0.05$), and homogeneity (Levene’s test $p > 0.05$) validated the overall data quality.

The findings carry significant implications for workplace health and ergonomics. Scapular dyskinesia is not merely a clinical diagnosis but a functional barrier that can impair productivity, concentration, and overall worker well-being. By identifying the link between SD and work- related pain, this study advocates for timely and preventive interventions.

Importantly, the role of assertiveness in reporting pain and discomfort is emphasized. Encouraging self-reporting can help in early diagnosis and management, particularly in corporate cultures where musculoskeletal discomfort is often ignored until it becomes chronic. The research also highlights the need for personalized physiotherapy plans tailored to each individual’s scapular dysfunction profile. Additionally, the study recommends non-surgical approaches—particularly physiotherapy and ergonomic corrections—as primary treatments. These not only restore scapular stability but also promote long-term recovery. Organizational policies should incorporate ergonomic assessments, regular breaks, and workplace wellness programs to mitigate the risk of SD.

Despite its strengths, the study has notable limitations. The cross-sectional design limits causal inference, as it cannot determine whether SD causes pain or if pain influences scapular motion. A longitudinal design would provide better insights into the progression of SD. Geographic limitation to Karachi further restricts generalizability. Office environments, stress levels, and ergonomic standards vary across regions, so the results may not apply universally. The strict exclusion criteria also pose a limitation. Excluding individuals with a BMI >39, past surgeries, or systemic conditions may bias the sample and limit real-world applicability, especially considering that many office workers have comorbidities. Another limitation lies in the reliability of the measurement tools. Both LSST and VAS demonstrated low internal consistency, calling into question the precision and reproducibility of results. Subjective pain reporting and manual scapular assessments may also introduce observer and respondent bias. Lastly, the study does not account for psychological and occupational stress factors—known contributors to musculoskeletal issues. Their omission leaves a gap in understanding the full spectrum of influences on SD.

To enhance future research, several key recommendations are proposed. Firstly, adopting a longitudinal design would help establish causal relationships and track the progression of SD over time. Secondly, geographic diversity should be introduced by expanding the study to multiple cities or countries to improve external validity. This would accommodate variations in work culture and environmental stressors. Thirdly, the inclusion criteria should be broadened to include participants with common comorbidities such as obesity or past surgeries, allowing for a more representative sample. Fourth, more reliable diagnostic tools like 3D motion analysis or Electromyography should be used to improve data accuracy. Additionally, incorporating inter- rater reliability testing can reduce observational bias during assessments. Fifth, psychological and occupational stress scales should be included to account for mental health influences on musculoskeletal pain. Lastly, standardized training for observers and assessors should be implemented to ensure consistency across data collection. Organizations should also be encouraged to implement ergonomic interventions and promote workplace wellness to proactively manage SD. This study provides valuable insights into the high prevalence and impact of scapular dyskinesia among office workers, especially in the 26–30-year age group. It confirms strong associations between scapular instability, pain, and poor ergonomic practices. While methodological limitations exist, the findings serve as a call to action for both researchers and employers to invest in preventive strategies, ergonomic education, and rehabilitation programs. By addressing scapular dyskinesia proactively, workplaces can enhance employee health, reduce pain, and improve productivity.

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