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ASSOCIATION BETWEEN SITTING POSTURE AND BACK PAIN IN COLLEGE STUDENTS IN KARACHI: CROSS SECTIONAL STUDY

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ABSTRACT

Background: College students typically experience back pain, which is frequently caused by extended sitting and bad posture. Inappropriate seating arrangements, prolonged study sessions, and electronic device use all contribute to musculoskeletal pain. This study highlights the need of awareness and preventive measures by examining the relationship between sitting position and back pain.
Objective: The purpose of this study is to look into the relationship between college students' back pain and their sitting position. It examines for typical postural behaviors, evaluates how they affect spinal health, and identifies risk factors for back pain. The study also aims to raise awareness and provide preventative measures to enhance students' posture and reduce their discomfort.
Method: This study explores the link between college students' back pain and sitting posture through a cross-sectional survey and observation. Data is collected using questionnaires on sitting habits and self-reported pain. Posture assessments identify common postural changes. Statistical analysis is used to find correlations between posture and back pain.
Result: The study identified a strong connection between poor sitting posture and back pain in Karachi college students. NMQ and VAS data showed a high prevalence of lower back pain in both short- and long-term durations. Correlation analysis linked specific pain regions to poor posture. Chi-square tests confirmed statistical significance by rejecting null hypotheses. Diagnostic assessments

supported the reliability and accuracy of the findings.
Conclusion: The research finds that bad sitting posture is a major cause of low back pain in Karachi's college students, especially in younger and female students. Prolonged sitting during academic tasks is frequently linked to lower back and neck pain, according to NMQ and VAS data. These findings emphasize the biomechanical effects of bad posture on spinal health and stress the critical necessity to encourage preventive techniques, posture education, and ergonomic awareness in schools.

INTRODUCTION

Although back pain is a significant public health issue, little is known about its risk factors and underlying causes. One of the most prevalent symptoms is back pain. It happens in nations with rich, middle, and low incomes, and it affects people of all ages, from young children to the elderly. Early-onset back pain is thought to be a predictor of chronicity. Back pain is a prevalent musculoskeletal issue that can impact students' everyday activities.. Medical students, especially those who study using computers, are at a greater risk for LBP because of extended periods of sitting and poor seating posture during lectures. The Quebec Back Pain Disability Scale is an innovative assessment tool designed to evaluate functional disability in individuals suffering from back pain. Functional disability is defined in terms of the perceived challenges faced when performing basic physical tasks. Among a cohort of student volunteers, fifty percent indicated experiencing back pain related to their posture. The group experiencing back pain tended to sit for extended periods without breaks and adopted a more relaxed, flexed sitting position compared to those without back pain. In this nation, harmful back pain can be considered a component of the social inferiority syndrome. Future cross-regional comparisons of back pain should focus more on educational status. Sitting posture is linked to work-related LBP because it reduces lumbar lordosis and increases low back muscle activity, disc pressure, and pressure on the ischium. It may be possible to improve sitting comfort and lower the risk of LBP by using a device that lowers spinal load and low back muscle activity. Prolong sitting is an issue among college students, who are a sitting population. There is a lack of comprehensive research on body posture in college students, with the majority of current studies focus on young people and teenagers. Ergonomic chair design improves productivity, enhances high-quality instruction, helps students adopt good posture, and lowers the risk of musculoskeletal conditions. An ergonomic chair with movable components was created to ensure that the furniture and students' postural traits fit. Students' musculoskeletal issues can be decreased by such a chair. This chair's adjustable footrest, backrest, armrests, and workstation are some of its ergonomic features. Many kids with varying body sizes can use a chair with this feature. Because of the flexion relaxation phenomena, low back muscle activation was extremely low when seated.

One of the most significant societal issues contributing to injuries among young people is low back pain.A systematic review by Hoy et al. (2014) found that, depending on the demographic and technique, the prevalence of back pain varies from 7% to 55% worldwide. It is possible for the lifetime prevalence to reach 84%. According to a study by Anis et al. (2020), back pain prevalence in Asia varies greatly by nation, with rates ranging from 10% to 40% in various ethnicities. Sedentary lifestyles, inadequate ergonomics, and ignorance of good posture are some of the factors causing its prevalence. Approximately 30% of teenagers suffer low back pain, and 88% of those who do so later in life also experience low back pain. One study [5%], four studies [18%], and seventeen studies [77%] were assessed as low quality, moderate quality, and high quality, respectively. Ten studies evaluated sitting posture, thirteen examined sitting behavior, and thirteen evaluated sitting time. Eight of the studies that

looked into sitting time revealed a correlation with the prevalence of low back pain (LBP), whereas five showed no correlation at all. Seven of the studies that looked at sitting position discovered a connection with LBP. Twelve studies found a relationship between LBP prevalence and sitting behavior, while just one found no relationship at all 30 to 70 percent of college students have it; it has been related to workers' sitting positions, although there hasn't been much research on it in university populations. 55.7% of people reported having back discomfort during the previous three months. Back discomfort is related to the following variables, according to the multivariate analysis: sex, parents who have back pain, weekly physical activity frequency, daily television viewing, studying in bed, sitting posture for writing and computer use, and bag carrying technique. Prevalence of low back pain, to determine self-reported triggers of back pain, and to look into how medical students' mood and everyday activities are affected by felt pain. 75.8% of people have low back discomfort in their lives. 12.4% of the students reported having chronic low back pain. Female medical students had significantly higher prevalence rates for both lifetime and 12-month low back pain. Female students reported self-perceived triggers of low back pain considerably more frequently than male students, including mental tension during an exam time ($p = 0.001$), sitting at the university ($p = 0.002$), tiredness ($p = 0.043$), incorrect body posture ($p = 0.005$), and lack of exercise ($p = 0.001$). For a long period of time, operators of video display terminals (VDTs) must remain seated. In a population of VDT operators, this global investigation evaluated the prevalence of lumbar musculoskeletal disorders (low back pain, or LBP) and associated outcomes with working environments and other interfering variables.. Adolescents aged 14 to 16 now have not particular low back pain (LBP) at a rate that is almost identical to that of adults. The use of different outcome measures, the terminology used in the questionnaire, and variations in age and gender are some of the reasons why reported prevalence vary widely. For physical considerations, there was a significant correlation between chair features and neck and low back pain. Students' reports of low desk height were significantly associated with low back pain. It was determined that among these kids in intermediate school, back discomfort was more closely associated with psychological, social, and emotional aspects than with physical ones.. The majority of college students' time is spent sitting in classrooms. Students suffer from various musculoskeletal disorders (MSDs) as a result of prolonged sitting on uncomfortable furniture and the resulting bad posture. The risk of developing LBP was not linked to sitting alone. However, the risk of LBP quadrupled when the co-exposure factors of awkward postures. Awkward posture was also independently associated with the presence of LBP and/or sciatica. The risk effect of prolonged sitting increased significantly when the factors of WBV and awkward postures were combined. Sitting by itself does not increase the risk of LBP. However, sitting for more than half a workday, in combination with WBV and/or awkward postures, does increase the likelihood of having LBP and/or sciatica, and it is the combination of those risk factors, which leads to the greatest increase in LBP. Musculoskeletal diseases (MSDs) are common among individuals who use computers. Musculoskeletal diseases (MSDs) may develop from prolonged computer desktop sitting in inappropriate, uncomfortable, and static positions. Visual problems are also linked to improper monitor positioning, lighting, and other elements like extended computer use. Core strengthening exercises are used in the treatment of back pain. According to the American Physical Therapy Association guidelines, moderate- to high-intensity exercises are recommended for LBP without progressive pain, and low-intensity exercises for LBP with generalized pain. CORE exercise program is effective in decreasing pain and increasing AROM in patients with chronic low back pain. Therefore, patients with persistent low back pain can benefit from the CORE exercise program in terms of pain management and AROM. For 4 weeks, the CORE group worked in the CORE fitness program for 30 minutes each day, three times a week, while the control group did not engage in any physical activity. Before and after the intervention, pain-free AROM in the trunk was measured using an algometer and the visual analog scale (VAS).

This study highlights the significance of better ergonomic practices and focused interventions to reduce musculoskeletal discomfort in this population by highlighting the significant effect that extended sitting and bad posture have on back pain among college students in Karachi.

METHODOLOGY

Study Design:

The study was an observational Cross-sectional study..

Sampling Technique:

It was a non-probability convenience sampling technique.

Outcome Measures

The two outcome Measure tool is used in this research study. NMQ-E Questionnaire and VAS scale.

Data Analysis

Statistical analyses were performed by SPSS version 29 to Find out the association between sitting posture and back pain. The data was analyzed by using statistical technique Chi square test.

Ethical Consideration:

This study ensured informed consent through written consent forms and clear explanations of the research purpose and procedures. Participants' confidentiality was maintained throughout the study and secure data storage. Ethical approval was sought in accordance with institutional guidelines. The anticipated benefits of identifying posture-related health risks outweighed any minimal discomfort or risks involved. No conflict of interest was reported by the researchers.

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.

RESULT:

Introduction

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 nine 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 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 chapter briefly along with results of this research.

4.1.1. Data Visualization

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

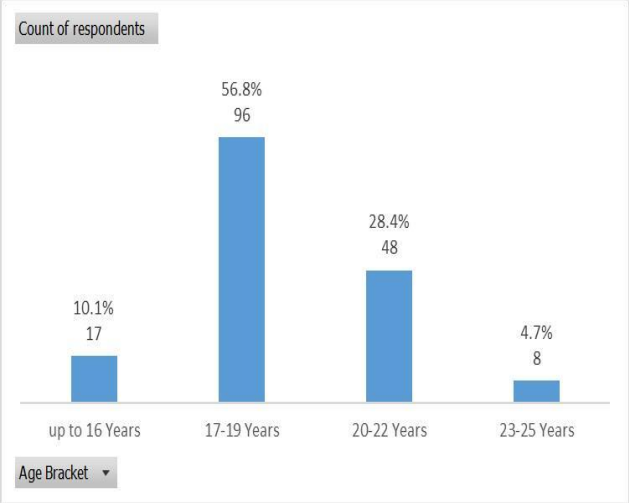


Chart-01 showing that one-hundred and sixty-nine respondents have examine for research consist with four (04) age- brackets i.e., 17 respondents (10.1% of population) having age bracket of up to 16 years old, 96 respondents (56.8% of population) having age bracket of 17-19 years old, 48 respondents (28.4% of population) having age bracket of 20-22 years old and 08 respondents (4.7% of population) having age bracket of above 23-25 years old.

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

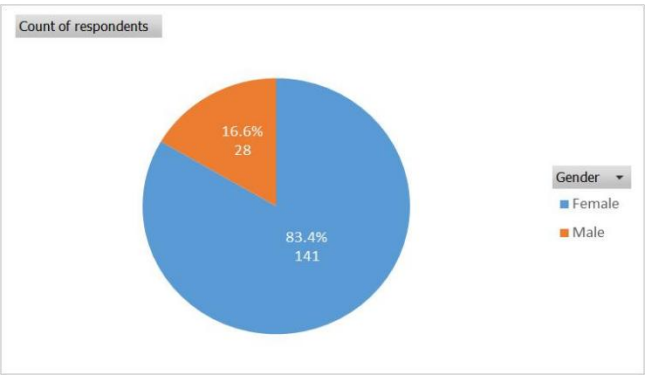


Chart-2 showing that One-hundred and sixty-nine respondents have examine for research consist with two (02) categories i.e., 141 respondents (83.4% of population) are female and 28 respondents (16.6% of population) are male.

Descriptive Statistics

Table 1: Descriptive Analysis of Dependent-variables Scale:

DV Elements	N	Min.	Max.	Mean	SD	Variance	%
Age bracket	169	15	20	15	.707	.500	75.0%
Gender	169	1	2	1.2	.373	.139	58.3%

Above table showing descriptive analysis of dependent variables related to Association between the sitting posture and back pain in college students in karachi showing that each element showing how frequently respondents made assertive answers against these questions; results showing that respondents have highest age is 20, lowest age is 15 within average of 17.5.

Table 2: Descriptive Analysis of NMQ Scale (Pain 12-Month duration in Organs):

NMQ-Pain duration in Organs	N	Min.	Max.	Mean	SD	Variance	%
Pain since 12-Months-Neck	169	0	1	0.53	.500	.250	53.3%
Pain since 12-Months-shoulders	169	0	1	0.51	.501	.251	51.5%
Pain since 12-Months-elbow	169	0	1	0.09	.285	.081	8.9%
Pain since 12-Months-wrist	169	0	1	0.17	.373	.139	16.6%
Pain since 12-Months-upper back	169	0	1	0.38	.488	.238	38.5%
Pain since 12-Months-lower back	169	0	1	0.49	.501	.251	49.1%
Pain since 12-Months-hips	169	0	1	0.09	.285	.081	8.9%
Pain since 12-Months-knees	169	0	1	0.22	.415	.172	21.9%
Pain since 12-Months-ankles	169	0	1	0.20	.398	.158	19.5%

Above table showing descriptive analysis of NMQ related to Association between the sitting posture and back pain in college students in karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Association between the sitting posture and back pain in college students in karachi here and in the rest of documents as well; showing that 53.3% respondents have highest response for item "Pain since 12-Months-neck" and 8.9% respondents have lowest response for item "Pain since 12-Months-elbow" and "Pain since 12-Months-hips" each.

Table 3: Descriptive Analysis of NMQ Scale (Pain 07-days duration in Organs):

NMQ-Pain duration in Organs	N	Min.	Max.	Mean	SD	Variance	%
Pain since 07-Days-Neck	169	0	1	0.52	.501	.251	52.1%
Pain since 07-Days-shoulders	169	0	1	0.55	.499	.249	55.0%
Pain since 07-Days-elbow	169	0	1	0.14	.350	.123	14.2%
Pain since 07-Days-wrists	169	0	1	0.20	.398	.158	19.5%
Pain since 07-Days-upper back	169	0	1	0.43	.497	.247	43.2%
Pain since 07-Days-lower back	169	0	1	0.57	.496	.246	57.4%
Pain since 07-Days-hips	169	0	1	0.12	.324	.105	11.8%
Pain since 07-Days-knees	169	0	1	0.25	.433	.188	24.9%
Pain since 07-Days-ankles	169	0	1	0.17	.378	.143	17.2%

Above table showing descriptive analysis of NMQ related to Association between the sitting posture and back pain in college students in karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Association between the sitting posture and back pain in college students in karachi here and in the rest of documents as well; showing that 57.4% respondents have highest response for item "Pain since 07-Days-lower back" and 11.8% respondents have lowest response for item "Pain since 07-Days-hips".

Table 4: Descriptive Analysis of NMQ Scale (Pain 07-days duration in Organs):

NMQ-Work prevention due to Pain	N	Min.	Max.	Mean	SD	Variance	%
Work prevention since12-Months-Neck	169	0	1	0.54	.500	.250	53.8%
Work prevention since12-Months-Shoulder	169	0	1	0.52	.501	.251	52.1%
Work prevention since12-Months-Elbow	169	0	1	0.54	.500	.250	53.8%
Work prevention since12-Months-Wrist/Hand	169	0	1	0.55	.499	.249	55.0%
Work prevention since12-Months-Upper Back	169	0	1	0.54	.500	.250	54.4%
Work prevention since12-Months-lower Back	169	0	1	0.56	.498	.248	55.6%
Work prevention since12-Months-Hips/Thighs	169	0	1	0.54	.500	.250	53.8%
Work prevention since12-Months-Knees	169	0	1	0.57	.497	.247	56.8%
Work prevention since12-Months-Ankles/Feet	169	0	1	0.54	.500	.250	53.8%

Above table showing descriptive analysis of NMQ related to Association between the sitting posture and back pain in college students in karachi; study of each element showing how frequently respondents made assertive answers against these questions. NMQ is the parameters to show the overall involvement of respondents in response to assess the Association between the sitting posture and back pain in college students in karachi here and in the rest of documents as well; showing that 56.8% respondents have highest response for item "Work prevention since12-Months-Knees" and 52.1% respondents have lowest response for item "Work prevention since12-Months-Shoulder".

4.2. 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 5: Correlation Analysis of NMQ prevalence: Annexed table-01 is Correlation Analysis of NMQ assessment of pain shows the correlation between items of NMQ prevalence of our research data. Directions of relations among has positive and negative impact for Association between the sitting posture and back pain in college students in karachi. Results showing that "Pain since 07-Days-lower back" have highest positive relationship to i.e. 42.0%, and the least relationship has found positive impact of item "Pain since 07-Days-wrists" i.e. 1.0% is correlated positively with pain prevalence.

Table 6: Correlation Analysis of VAS prevalence: Annexed table-02 is Correlation Analysis of NMQ assessment of pain shows the correlation between items of NMQ prevalence of our research data. Directions of relations among has positive and negative impact for Association between the sitting posture and back pain in college students in karachi. Results showing that "Pain since 12-Months-lower back" have highest positive relationship to i.e. 40.0%, and the least relationship has found positive impact of item "Pain since 12-Months-elbow" i.e. 6.0% is correlated positively with VAS prevalence.

4.3. Chi-Square

Chi-Square is a statistical measure which compares the actual and expected results leading to accept or reject null hypothesis. We reject the null hypothesis if the chi-square value is greater than the critical value. If you reject the null hypothesis, you can conclude that your data are significantly different from what you expected. Here we assume four (04) null hypotheses are as under to assess:

HO_1: There is no significant relationship between age groups and Association between the sitting posture and back pain in college students in karachi

HA_1: There is significant relationship between age groups and Association between the sitting posture and back pain in college students in karachi

HO_2: There is no significant relationship between gender and Association between the sitting posture and back pain in college students in karachi

HA_2: There is significant relationship between gender and Association between the sitting posture and back pain in college students in karachi.

Table 4: Case Processing Summary:

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Musculoskeletal pain	169	100%	0	0%	169	100%
Age * Pain severity	169	100%	0	0%	169	100%
Gender * Musculoskeletal pain	169	100%	0	0%	169	100%
Gender * Pain severity	169	100%	0	0%	169	100%

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

Table 5: Chi-Square Tests:

Test Element	Pearson Chi-Square	p-value	Result
Age * Musculoskeletal pain	2.722	0.436	Null hypothesis rejected
Age * Pain severity	7.995	0.786	Null hypothesis rejected
Gender * Musculoskeletal pain	9.444	0.002	Null hypothesis rejected
Gender * Pain severity	3.806	0.433	Null hypothesis rejected

Above table showing that each element has greater chi-square value than of p-value; resulting that

each HO have rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Association between the sitting posture and back pain in college students in karachi.

4.4. 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.

4.4.1. 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	%
	Valid	169	100
Cases	Excluded [a]	0	0
	Total	169	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
NMQ	0.768	36
Overall (NMQ + VAS)	0.785	37

Above table shows that Cronbach's Alpha of two (02) scale; NMQ questionnaire is 0.768 with thirty-six (36) items which show good reliability of NMQ questionnaire and NMQ + VAS questionnaire is 0.785 with thirty- seven (37) items which show good reliability of overall reliability of both questionnaire.

4.6.2. 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:	
Age Bracket	1.041
Gender	1.041
a. Dependent Variable: NMQ-Musculoskeletal Pain prevelance and Pain Severity	

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.

4.6.3. Normality Test: Normality Test determines whether sample data has been drawn from a normally distributed 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 pain prevalence:

		Shapiro-Wilk		
Musculoskeletal-pain prevelance		Statistic	Sig.	Remarks
Age	up to 16 Years	0.579	0.000	
	17-19 Years	0.636	0.000	
	20-22 Years	0.636	0.000	
	23-25 Years	0.665	0.001	
Gender	Male	0.635	0.000	
	Female	0.508	0.000	

Table-10: Normality tests of pain severity:

		Shapiro-Wilk		
Pain Severity		Statistic	Sig.	Remarks
Age	up to 16 Years	0.862	0.016	
	17-19 Years	0.819	0.000	
	20-22 Years	0.830	0.000	
	23-25 Years	0.912	0.366	
Gender	Male	0.823	0.000	
	Female	0.863	0.002	

Above table shows that each dimension of pain severity has derived from a normal distributed population for assessment of all factors have significant impact on Association between the sitting posture and back pain in college students in karachi as value of the Shapiro-Wilk test is greater than 0.05 for all elements for all assessments.

4.6.4. 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.
Musculoskeletal pain	Age Bracket	9.507	0.000
	Gender	60.278	0.000
Pain severity	Age Bracket	1.246	0.295
	Gender	1.381	0.242

Above table shows that population of all elements for assessment of all factors have significant impact on Association between the sitting posture and back pain in college students in karachi Here for age bracket and gende p-value is less than 0.05 in pain assessment; hence homogeneity assumption of the variance is not met; have a mean that spread of data within each combination of factors should be fit-for-analysis.

Whereas for pain severity; p-value is more than 0.05; 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.

4.6. 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 the sitting posture and back pain in college students in karachi as dependent variable are influenced by a set of independent variables This research has assessed with NMQ aiming to make this research as multi-dimensional assessment of deep insight of reasons of assertiveness to Association between the sitting posture and back pain in college students in karachi.

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 the sitting posture and back pain in college students in karachi Results showing how frequently respondents made assertive answers against these questions that respondents have Association between the sitting posture and back pain in college students in karachi. Respondents. Data shown that respondents have highest age is 20, lowest age is 15 within average of 17.5. Similarly, for NMQ, showing that 53.3% respondents have highest response for item “Pain since 12-Months- neck” and 8.9% respondents have lowest response for item “Pain since 12-Months-elbow” and “Pain since 12- Months-hips” each for 12 Month assessment. Moreover, showing that 57.4% respondents have highest response for item “Pain since 07-Days-lower back” and 11.8% respondents have lowest response for item “Pain since 07-Days-hips” for 07 days assessment. Additionally, showing that 56.8% respondents have highest response for item “Work prevention since12-Months-Knees” and 52.1% respondents have lowest response for item “Work prevention since12-Months-Shoulder” in assessment of Work prevention.

In the fourth section, Correlation Analysis shows the correlations between scales on prevalence with positive and negative impact to Association between the sitting posture and back pain in college students in karachi NMQ results showing Results showing Results showing that “Pain since 07-Days-lower back” have highest positive relationship to i.e. 42.0%, and the least relationship has found positive impact of item “Pain since 07- Days-wrists” i.e. 1.0% is correlated positively with pain prevalence. posture and back pain in college students in karachi. Moreover, VAS based results showing that “Pain since 12-Months-lower back” have highest positive relationship to i.e. 40.0%, and the least relationship has found positive impact of item “Pain since 12-Months-elbow” i.e. 6.0% is correlated positively with VAS prevalence.

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; resulting that each HO have rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Association between the sitting posture and back pain in college students in karachi.

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

Reliability tests shows shows Above table shows that Cronbach's Alpha of two (02) scale; NMQ questionnaire is 0.768 with thirty-six (36) items

which show good reliability of NMQ questionnaire and NMQ + VAS questionnaire is 0.785 with thirty-seven (37) items which show good reliability of overall reliability of both questionnaire.

Multicollinearity is a situation in which two or more explanatory variables in a model are highly linearly related.

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 the statistical analyses.

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. Above table shows that population of all elements for assessment of all factors have significant impact on Association between the sitting posture and back pain in college students in karachi Here for age bracket and gende p-value is less than 0.05 in pain assessment; hence homogeneity assumption of the variance is not met; have a mean that spread of data within each combination of factors should be fit-for-analysis. Whereas for pain severity; p-value is more than 0.05; 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.

Pain Prevalence:

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

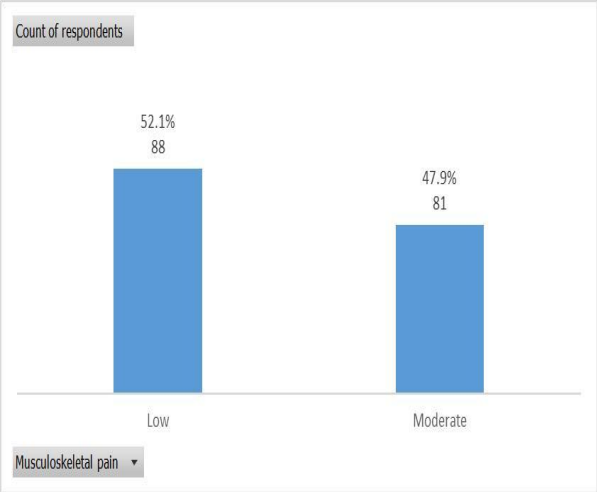


Chart showing that one-hundred and sixty-nine respondents have examined for research consists with two (02) states of pain according to NMQ i.e., 88 respondents (52.1% of population) have low pain and 81 respondents (47.9% of population) have moderate pain.

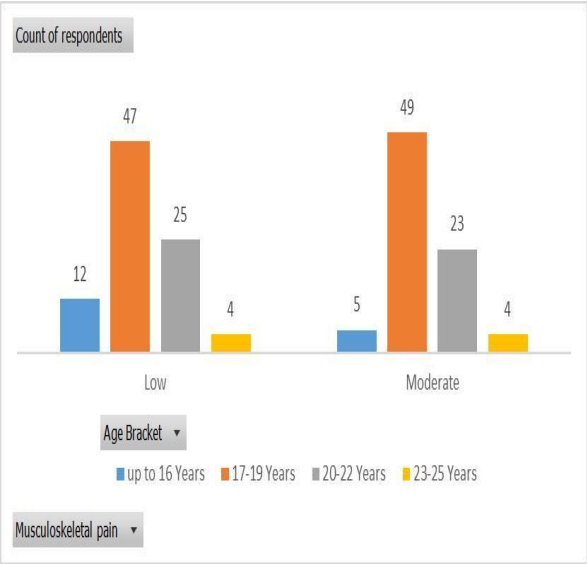


Chart showing that one-hundred and sixty-nine respondents have examine for research consist with three (02) states of pain according to NMQ along with four (04) age-brackets i.e., having highest count of 49 respondents (60.49% of population having moderate respondents) in age group of 17-19 years. Similarly, having lowest count of 04 respondents (4.9% of population having moderate respondents) in age group of 23-25 years.

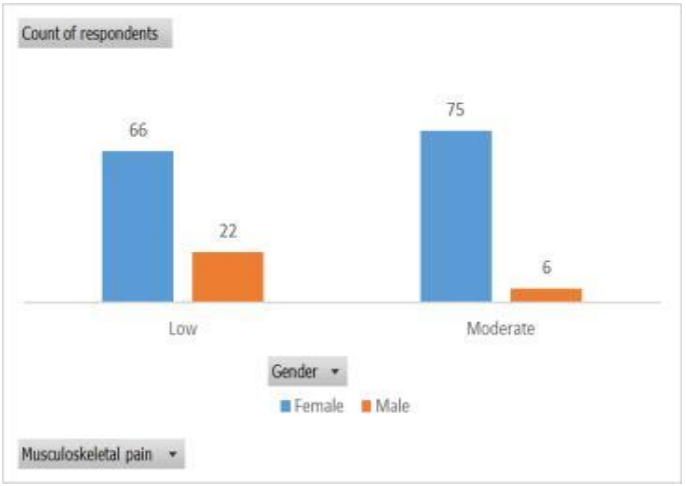


Chart showing that one-hundred and sixty-nine respondents have examine for research consist with two (02) states of pain according to NMQ along with two (02) genders i.e., having highest count of 75 respondents (92.59% of population having moderate respondents) in female group. Similarly, having lowest count of 06 respondent (7.4% of population having moderate respondents) in male.

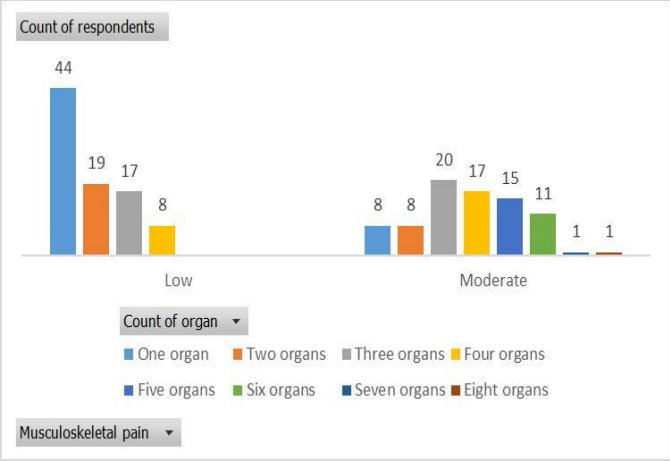


Chart showing that one-hundred and sixty-nine respondents have examine that how many respondents having pain in one or more than one organs; it reveals that highest count of 20 respondents (24.69% of population having moderate respondents) having pain in three (03) organs. Similarly, having lowest count of 01 respondent (1.23% of population having moderate respondents) having pain in seven (07) and eight (08) organs each.

Pain Severity:

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

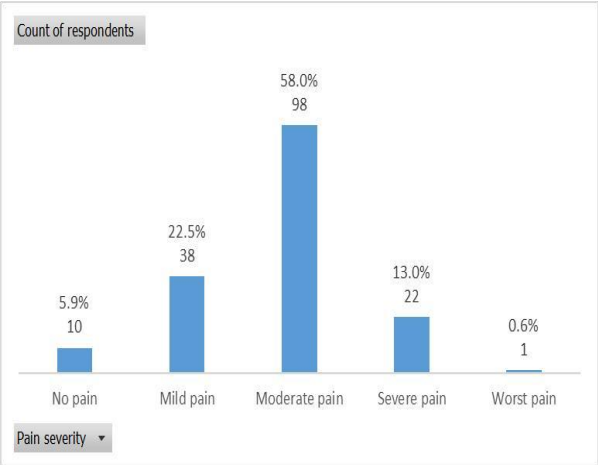


Chart showing that one-hundred and sixty-nine respondents have examined for research consists with five (05) states of pain severity according to VAS i.e., 10 respondents (5.9% of population) have no pain, 38 respondents (22.5% of population) have mild pain, 98 respondents (58.0% of population) have moderate pain, 22 respondents (13.0% of population) have severe pain and 01 respondents (0.6% of population) have worst pain.

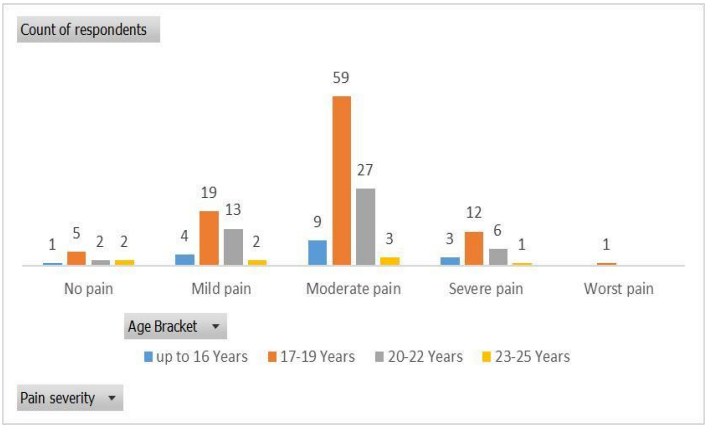


Chart showing that one-hundred and sixty-nine respondents have examine for research consist with five (05) states of pain according to VAS along with four (04) age-brackets i.e., having highest count of 06 respondents (31.8% of population having severe) in age group of and 20-22 years. Similarly, having lowest count of 01 respondents (100% of population having worst respondents) in age group of up to 17-19 years.

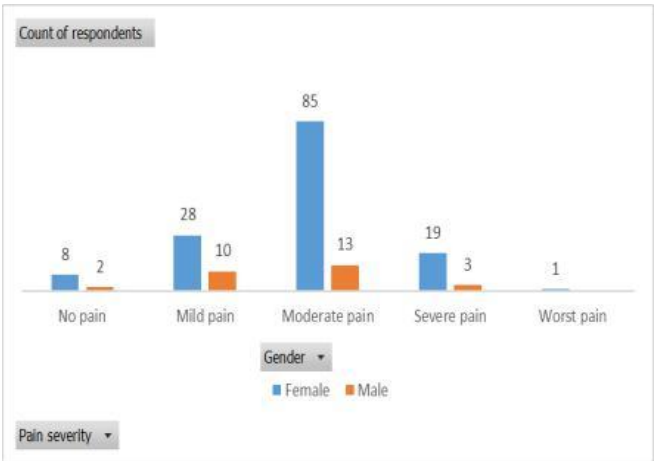


Chart showing that one-hundred and sixty-nine respondents have examine for research consist with FIVE (05) states of pain according to VAS along with

two (02) genders i.e., having highest count of 19 respondents (86.36% of population having severe respondents) in female group. Similarly, having lowest count of 01 respondent (100% of population having worst respondents) in male.

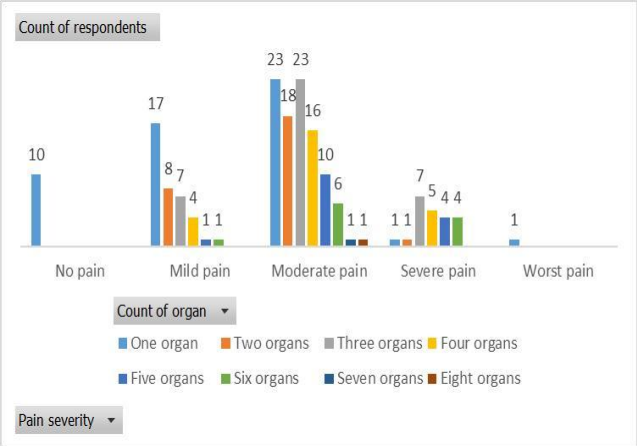
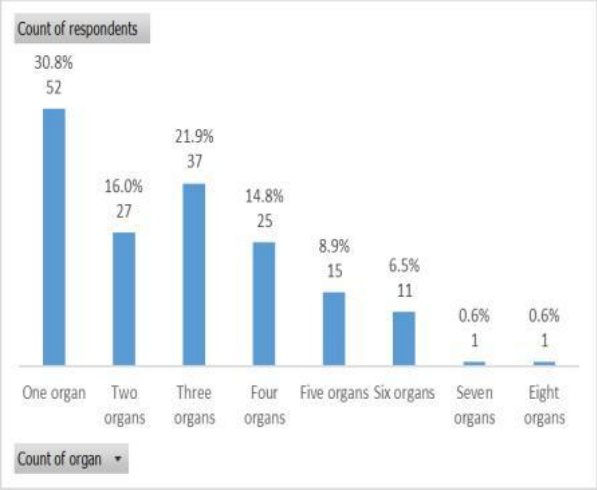
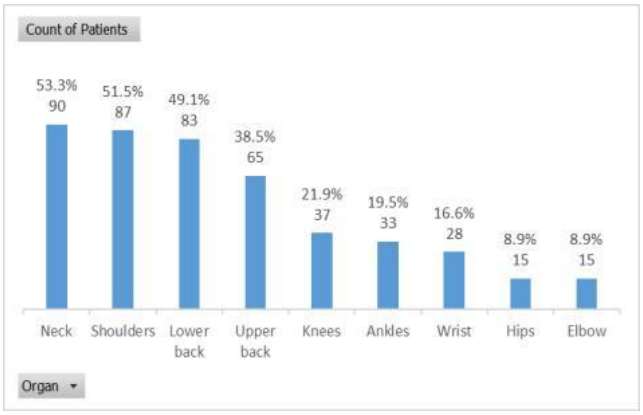


Chart showing that one-hundred and sixty-nine respondents have examine that how many respondents having pain in one or more than one organs; it reveals that highest count of 7 respondents (31.8% of population having severe respondents) having pain in three (03) organs. Similarly, having lowest count of 01 respondent (100% of population having worst respondents) having pain in one (01) organ.



Above chart elaborate that how our selected population are segregated in to count of organs have affected in a patients. Results showing that highest number is 52 respondents (30.7% of population) have pain in one organ and,lowest in seven (07)and eight (08) respondents each.



Above chart elaborate that which organs of our selected population are highly affected in a patients. Results showing that neck-pain severity is most common in our population as 90 respondents (53.3% of population) and lowest is15 each in hips and elbow each.

DISCUSSION

Back pain is a widespread public health concern affecting individuals of all ages and income levels. Early- onset back pain can lead to chronic conditions, and its impact is notably significant among college and medical students due to prolonged sitting, poor posture, and sedentary habits. In particular, students who spend extended hours using computers or sitting without ergonomic support are at greater risk of developing low back pain (LBP). Several studies have found that posture, sitting behavior, and time spent sitting are significantly linked to LBP prevalence. College students, who represent a largely sedentary population, often experience musculoskeletal disorders (MSDs) due to prolonged sitting on poorly designed furniture. Female students are more prone to LBP, citing stress, fatigue, improper posture, and lack of physical activity as key contributors. The Quebec Back Pain Disability Scale is used to assess functional disability due to back pain. Among student cohorts, approximately 50–75% reported experiencing LBP, with many attributing it to incorrect posture and extended sitting. Physical factors such as low desk height and poor chair design are strongly associated with discomfort, while psychological and emotional factors also play a role, particularly in younger students. Ergonomically designed chairs, with adjustable features such as footrests, backrests, and armrests, can reduce back pain and improve posture and productivity. Despite sitting alone not being a sole cause of LBP, its combination with awkward postures and whole-body vibration (WBV) significantly increases risk. Core strengthening exercises have been found effective in reducing pain and improving range of motion in chronic LBP patients. The study underscores the importance of ergonomic interventions, awareness about posture, and regular physical activity to manage and prevent LBP among college students, particularly in Karachi, where research on this issue remains limited but increasingly vital

LIMITATIONS

While this study provides valuable insights into the association between sitting posture and back pain among college students in Karachi, several limitations must be acknowledged that could impact the generalizability and interpretation of the findings. Firstly, the study employed a non-random convenience sampling technique, which limits the representativeness of the sample. Participants were selected based on ease of access rather than through randomized procedures, introducing potential selection bias. As a result, the findings may not accurately reflect the broader population of college students across Karachi or other regions. Secondly, the cross-sectional design restricts the study's ability to establish causality. While associations between sitting posture and back pain were identified, the temporal relationship remains unclear. It cannot be determined whether poor posture caused back pain or whether existing pain influenced students' posture. Another limitation lies in the self-reported nature of data collection. Participants' responses regarding their sitting habits and pain experiences were subjective and may be affected by recall bias or misinterpretation of questions. Additionally, pain severity and postural assessments lacked clinical validation, which could reduce the accuracy of the data. The sample size, though statistically adequate, was relatively small and limited to college students aged 18–25. This narrow age range excludes younger and older populations who may also experience posture-related back issues. Furthermore, external factors such as physical activity levels, body mass index, stress, and ergonomic conditions at home or work were not controlled, which could confound the observed relationships. Lastly, the exclusion of individuals with pre-existing spinal or neurological conditions, while necessary for clarity, also limits the study's applicability to a broader population experiencing multifactorial back pain. Despite these

limitations, the study offers a foundational understanding that can inform future longitudinal and randomized research exploring posture and musculoskeletal health among youth.

RECOMMENDATIONS

To enhance the rigor and applicability of future research investigating the association between sitting posture and back pain among college students, several remedial measures are recommended to address the limitations identified in the current study. Firstly, the use of a non-random convenience sampling technique limits the representativeness of the sample and introduces potential selection bias. To overcome this, future studies should employ random or stratified sampling methods. These techniques would ensure more balanced representation across different subgroups of the student population, thereby increasing the generalizability of findings to a broader demographic. Secondly, the cross-sectional nature of the current research restricts its ability to establish a cause-and-effect relationship between poor posture and back pain. Future studies should adopt a longitudinal design, which involves tracking participants over time. This would allow researchers to observe the temporal sequence of posture changes and the onset or progression of back pain, thereby strengthening the causal inference. Another key limitation lies in the reliance on self-reported data, which is subject to recall bias and subjective interpretation. To improve data accuracy, future research should integrate objective measures, such as digital posture analysis or wearable posture trackers, along with clinically validated pain assessment tools. Involving trained healthcare professionals in evaluating participants' posture and pain levels can further enhance the reliability of results. Additionally, expanding the sample size and age range would improve the study's applicability. Including a more diverse participant pool from various educational institutions and geographic locations can provide a more comprehensive understanding of the issue. It is also essential to account for potential confounding factors, such as physical activity, body mass index, stress, and ergonomic environments, all of which may influence both posture and back pain. Lastly, slightly broadening the inclusion criteria to incorporate individuals with manageable pre-existing conditions could allow the findings to be more applicable to real-world settings without compromising analytical clarity. By addressing these limitations, future research can generate more robust evidence to guide interventions, health policies, and ergonomic strategies for student populations.

CONCLUSION

This study offers important insights into the relationship between sitting posture and back pain among college students in Karachi, highlighting a frequently overlooked but increasingly relevant public health issue. Through the use of validated tools such as the Nordic Musculoskeletal Questionnaire (NMQ) and the Visual Analog Scale (VAS), the research presents a comprehensive analysis of pain prevalence, severity, and its association with postural habits and demographic variables. Findings revealed that more than half of the participants experienced moderate to severe levels of back pain, with the lower back and neck being the most commonly affected areas. Gender and age were also significant, with female students and younger age groups reporting higher levels of discomfort. These results affirm the hypothesis that poor sitting posture, particularly in the context of prolonged academic activities and inadequate ergonomic support, is a key contributor to musculoskeletal issues among students. Despite its limitations—such as a non-random sample, reliance on self-reported data, and a cross-sectional design—the study serves as a foundational step in understanding the postural health of the student

population in Karachi. It underscores the pressing need for institutional measures to improve ergonomic awareness and physical well-being. Interventions such as ergonomic furniture, posture education, regular physical activity, and scheduled breaks can significantly reduce the risk and severity of back pain. Moreover, the study lays the groundwork for future research by emphasizing the importance of longitudinal designs, diverse sampling, and objective clinical assessments. By identifying posture-related back pain as a critical area for intervention, this research contributes to both academic performance and overall health among students. It advocates for the integration of ergonomic strategies into educational policies, promoting healthier and more supportive learning environments that prioritize the musculoskeletal health of future generations.

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