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Original Article

Association of Carpal Tunnel Syndrome with Body Mass Index among University Students

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ABSTRACT

Background: Carpal tunnel syndrome is caused due to the compression of the median nerve in the carpal tunnel1, it is one of the most prevalent upper extremity neuropathies. Individuals with this syndrome commonly complain of pain, paraesthesia, altered sensory perception, and hand and wrist weakness, which impairs daily activities and diminishes physical function. **Objective:** Evaluate the association of carpal tunnel syndrome with body mass index among university students. **Methods:** An analytical cross-sectional study was conducted on female students of the University of Lahore and the University of Gujrat. Students were selected with different body mass indexes and ages between 18 to 30 years while data were collected by using a standardized questionnaire and by performing the Phalen's test whereas BMI was checked by using weight in kilograms divided by height in meter square. However, students with a history of hand trauma, radius/ulna or wrist fracture or injuries in the last three months and those who had comorbidities previously undergone surgery to the shoulder inflammatory arthritis in the last 3 months and congenital deformities were excluded. This study was conducted after obtaining ethical approval from the Institutional Review Board of the University of Lahore, Punjab, Pakistan. A consent was taken from the participants before collecting data. Ensured that data would be used for only research purposes. The research project was approved by the research and ethics committee of the University of Lahore. Data were collected from females of the University of Lahore and the University of Gujrat and by evaluating the carpal tunnel syndrome in university females by Phalen's test and Boston questionnaire. For descriptive analysis, mean and standard deviation were calculated for quantitative variables whereas frequencies and percentages were calculated for qualitative variables. For inferential statistics, a chi-square test was employed. **Results:** The study's results show that mean age of participants (years) is 22.30±2.04, body mass index of participants (kg/m²) is 20.36±2.63. **Conclusion:** It is concluded that there is no association between body mass index classes with p-value. The p-value shown in the results was 0.389. Therefore, both have no effects on each other, while body mass index and Phalen's test have very weak positive co-relation with each other with p-value of 0.045.

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INTRODUCTION

Carpal tunnel syndrome (CTS), is caused due to the compression of the median nerve in the carpal tunnel[1], it is one of the most prevalent upper extremity neuropathies. Individuals with CTS commonly complain of pain, paraesthesia, altered sensory perception, and hand and wrist weakness, which impairs daily activities and diminishes physical function, whereas secondary causes of CTS have been identified, including trauma, changes in metabolism, infections, neuropathies, and other systemic illnesses. The majority of CTS causes, however, are unknown.[2] Risk factors associated with body mass index (BMI) have been linked to the onset of CTS. Obesity is a risk factor that can be modified with lifestyle changes. Increased fluid collection in the tissue gaps of the carpal tunnel has been reported to enhance the incidence of CTS in people who have recently gained weight.[3] The cause of CTS is frequently unknown in many instances. Pain, paraesthesia, and weakness in the hand, particularly in the first three fingers at night, are signs of CTS and may extend up the arm into the shoulder.[4] The complications include CTS can cause atrophy and paresis of the muscles at the base of the thumb in the palm.

The physical therapy intervention includes Straightening the patient's arm with your palm facing down and bending your wrist so that your fingers point down. Gently pull your hand toward your body until you feel a stretch on the outside of your forearm. Treatment of CTS should start as early as possible. In a large percentage of cases where anatomical abnormalities of the carpal canal are not present, the functionality of the affected hand can be restored by appropriate physiotherapy rehabilitation programs.[5] CTS is one of the most prevalent upper limb entrapment neuropathies. Earlier studies have discovered a connection between CTS development and prolonged wrist use and repetitive wrist motion such as typing. Due to this reason, the current study aims to determine the association between carpal tunnel syndrome and BMI. The rationale of this study is firstly to diagnose carpal tunnel syndrome among university-going students and secondly to investigate their relationship to BMI. Whereas literature also supports the 2023 study on estimating carpal tunnel syndrome and severity where the research used the Boston Carpal Tunnel Syndrome Questionnaire to diagnose CTS and conclude that The results of our study revealed that CTS is a prevalent neuromuscular disorder. The severity level varies among the population.[6]

METHODS

An analytical cross-sectional study was conducted between March 2023 and July 2023. After obtaining the approval from ethical committee, a sample of 363 female Students of the age group 18-30 were selected from the University of Lahore and the University of Gujrat who agreed to participate in the study. Non-probability convenient sampling technique was used. Sample size n=363 was calculated using below mentioned formula[10] and WHO recommended calculator:

$$\frac{n=Z^2P(1-P)}{d2}$$

Where n is the sample size, z level of confidence, p estimated proportion and d is the tolerated margin of error. University female students aged between 18 to 30 years with no history of nerve injury or preexisting diseases and females with intact anatomy of wrist and joint. However students with a history of hand trauma, radius/ulna or wrist fracture or injuries in the last three months and those who had comorbidities that can root similar symptoms with CTS, like lesions in the CNS, cervical region, ulnar nerve, or radial nerve, formerly undergone surgery to the shoulder and non-conscious subjects, inflammatory arthritis in last three months and

congenital deformities were excluded. Ethical approval was taken from the Institutional Review Board (IRB) of The University of Lahore, Punjab, Pakistan. A consent was taken from the participants before collecting data. Ensured that data would be used for only research purposes. The research project was approved by the research and ethics committee of the University of Lahore. Data were collected from females of the University of Lahore and the University of Gujrat and by evaluating the carpal tunnel syndrome in university females by Phalen's test and Boston questionnaire. Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) software version 24. For descriptive analysis, mean and standard deviation were calculated for quantitative variables whereas frequencies and percentages were calculated for qualitative variables. For inferential statistics, a chi-square test was applied. All results were calculated at a 95% confidence interval and a p-value ≤0.05 was considered a significant value. Likelihood Ratio is 1.62 and Linear-by-Linear Association is 1.33.

RESULTS

The results of this analytical cross-sectional the study is mentioned in Table 1, which was drawn from a sample of 363 female Students of age between 18-30 years were selected. The results of the study showed that the mean age of participants is 22.3±2.04, body mass index of participants is 20.36±2.63. The frequency of underweight (BMI Score<18.5) was 92(25.3%), normal (BMI Score >18.5 to 25) were 239 (65.8%) and overweight (BMI Score >25 to 30) were 32(8.8%). The frequency of Negative test were 338(93.1%) while positive were 25(6.9%). Table 4 shows that 6.9% prevalence of CTS. Table 5 revealed that there is only a 0.045 correlation between BMI and Phalen's test.

DISCUSSION

This study was done to find the Association of carpal tunnel syndrome with BMI among university females. Different BMI university students aged between 18 to 30 years were selected and data were collected by using a standardized questionnaire and by performing the Phalen test BMI was checked by using weight in kilograms divided by height in meter square. The result of the study shows that the mean age of participants (in years) is 22.30±2.04, body mass index of participants

Figure 1: Phalen's Test

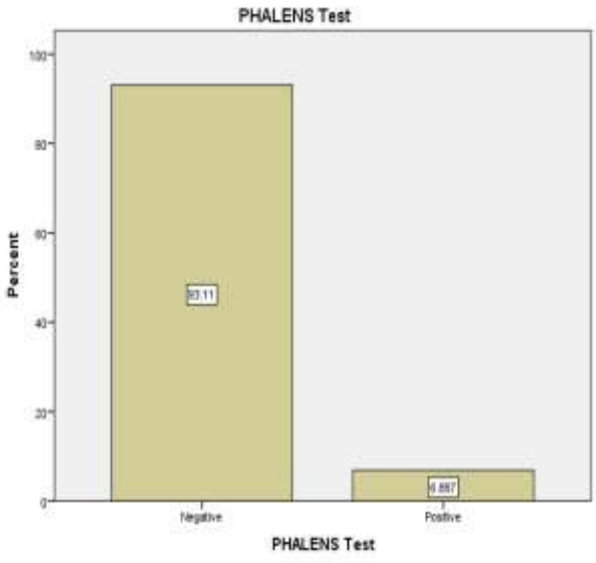

Figure 2: Cross-tabulation of BMI and Phalen's Test

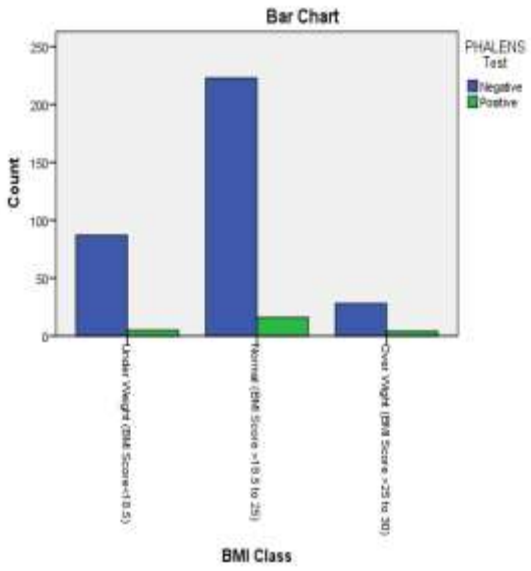

Table 1: Descriptive Statistics

Descriptive Statistics				
	Minimum	**Maximum**	**Mean**	**Std. Deviation**
Age of Participants (years)	18	29	22.3	2.04
Body Mass Index of Participants (kg/m²)	15.9	27.3	20.36	2.63
Frequency of BMI Class				
	Frequency	**Percentage**	**Valid Percent**	**Cumulative Percent**
Under Weight (BMI Score<18.5)	92	25.3	25.3	25.3
Normal (BMI Score >18.5 to 25)	239	65.8	65.8	91.2
Over Wight (BMI Score >25 to 30)	32	8.8	8.8	100
Frequency of Phalens Test				
			Phalen Test	
			Positive	**Negative**
Under Weight (BMI Score<18.5)			5	87
Normal (BMI Score >18.5 to 25)			16	223
Over Weight (BMI Score >25 to 30)			4	28
Chi-Square Tests				
		Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square		1.889[a]	2	0.389
Likelihood Ratio		1.626	2	0.444
Linear-by-Linear Association		1.337	1	0.248

Table 2: Cross-tabulation of Phalen's Test and BMI

	Frequency	**Percentage %**	**Valid Percent**	**Cumulative Percent**
Negative	338	93.1	93.1	93.1
Positive	25	6.9	6.9	100.0
Total	363	100.0	100.0	

Table 3: Co-relation of Phalen's Test and BMI

		BMI (kg/m²)	Phalens Test
BMI (kg/m²)	Pearson Correlation	1	.045
	Sig. (2-tailed)		.395
	N	363	363
Phalens Test	Pearson Correlation	.045	1
	Sig. (2-tailed)	.395	
	N	363	363

(kg/m²) is 20.36±2.63. There is no association between BMI and CTS with p-value. The p-value shown in the results was 0.389. Therefore, both do not affect each other, while BMI and Phalen's test have very weak positive co-relation with each other with a chi-square value of 0.045. Meanwhile, previous literature also supports that females are a risk factor for developing CTS. Women are two to three times more commonly affected by CTS than men.[7] Our study shows that the mean age of participants (in years) is 22.30±2.04, the Body mass index of Participants (in kg/m²) is 20.36±2.6, while in reference with a previous study conducted in 2023 where the mean age of participants was 50.9±10 years.[8]

Another study conducted in 2022 by Philip B. Adebayo showed the mean age 47.19±12.95 while the average body mass index of the participants of that study was 28.98±4.91.[9] BMI is an autonomous associated risk factor for the prevalence of CTS. People with obese status were found to have a 2.5 times higher risk of having CTS than people with lean body frame. Another study revealed that a one-unit increase in BMI increases the risk of CTS by 6%.[10] The study shows that the BMI class of participants. The frequency of underweight (BMI Score<18.5) was 92 (25.3), Normal (BMI Score >18.5 to 25) were 239 (65.8) and Overweight (BMI Score >25 to 30) was 32 (8.8). Whereas the previous research in 2020 by Amitava Pal shows that 33.66% of their respondents were underweight. About 55% were normal while 11.3% were overweight/obese.[11] Bestowing to the World Health Organization (2016), 39% of adults over 18 years are overweight, and around 13% of the world's adult population is obese. BMI is a frequently used index for overweight (BMI 25–29.9) and obesity (BMI ≥30), defined as the weight in kilograms divided by the square of his height in meters (kg/m^2).

Overweight and obesity are found to be risk factors of several diseases, including CTS.[12] To diagnose carpal tunnel syndrome, our study used Phalen's test which is one of the most widely used clinical tests to evaluate for carpal tunnel syndrome. The frequency of negative tests was 338(93.1) while positive were 25(6.9). Our study gets more negative tests than positive ones. In a previous study on work-related risk factors for carpal tunnel syndrome among Majmaah University female touchscreen users, the results of its study are in favour of our study its result also contains more negative students with a mean of 138(94.5), while the positive test participants were 28(5.5).[13] Our results show that BMI and Phalen's test has a very weak positive co-relation with each other with a value of 0.045. In 2021 Mohaddeseh Azadvari's study on Risk

Factors for Carpal Tunnel Syndrome supported our study that Phalen's test results were not statistically associated with the CTS status in relation to BMI (p=0.091).[14] The mechanisms by which superfluous body mass increases the risk of CTS are not fully understood. Adipose tissue in the carpal tunnel might constrict the tunnel, leading to median nerve compression. Increased pressure in the carpal tunnel may also decrease blood circulation, leading to median nerve ischemia, demyelination and axonal loss. Another conceivable mechanism is metabolic syndrome instigating median nerve injury by adipose deposition, upsetting extracellular protein glycation, mitochondrial dysfunction and oxidative stress. Tenosynovitis in the carpal tunnel, caused by inflammation through metabolic syndrome, is also a potential mechanism[15,16] The risk factors concomitant with Carpal Tunnel Syndrome include recurrent and unwarranted use of the wrist and hand, awkward postures, heavy lifting, and vibrations as well as particular predictors as female gender, obesity, older age, and smoking.

Musculoskeletal disorders which are associated with work among office workers are of attentiveness and focus among researchers because of their growing commonness. Wrist and hand musculoskeletal complaints were pretentious over 15% of occupational groups including office workers, nurses, and others[17] The sample size was large and it took a lot of time to collect data. People were reluctant to cooperate because they did not belong to the medical field and did not have any idea on how to perform the Phalen's test.

CONCLUSION

It is concluded that there is no association between BMI classes with p-value. The p-value shown in the results was 0.389. So both have no effects on each other, while BMI and Phalen's test has a very weak positive co-relation with each other with a value of 0.045.

DECLARATIONS

Consent from participants: The patient's written consent to participate had been obtained. All methods were carried out according to the applicable guidelines and regulations.

Availability of data: Data will be provided upon request. All data files will be submitted by the corresponding author.

Conflicting interests: Nil.

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Contributions of the authors: The authors listed below have made significant contributions to the manuscript.

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