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THE RELATIONSHIP BETWEEN SEX, BODY MASS INDEX, DURATION OF USE AND DEVICE SIZE WITH THE OCCURRENCE OF CARPAL TUNNEL SYNDROME

Jennifer Nathalie Kurniawan[1], I Nyoman Gede Wardana[2*], I Gusti Ayu Widianti[2], Muliani[2]
[1]Bachelor of Medicine, Faculty of Medicine, Universitas Udayana
[2]Department of Anatomy, Faculty of Medicine, Universitas Udayana
[*]Correspondence e-mail: mandewardana@unud.ac.id

ABSTRACT

Background: Carpal tunnel syndrome, characterised by wrist pain due to repetitive finger movements, is prevalent among students who frequently use digital devices. This research aims to examine the relationship between sex, body mass index, duration of use, and device size with the prevalence of carpal tunnel syndrome.
Methods: An observational cross-sectional analytic design was used, which involved 243 Bachelor of Medicine students from Universitas Udayana, batch 2021-2022. These participants were selected using purposive sampling technique, and all had met the inclusion and exclusion criteria. Data was collected in the form of interviews using questionnaires and analysed using a Chi-Square test with significance level of $\alpha = 0.05$.
Results: The prevalence of carpal tunnel syndrome is present in 118 (48.6%) respondents, with 83 (70.3%) respondents being female and 35 (29.7%) males. The results of Chi-Square test showed that there was no significant relationship between the prevalence of carpal tunnel syndrome and sex ($p = 0.193$), body mass index ($p = 0.699$), and device size ($p = 0.052$). However, there was a significant relationship between the prevalence of carpal tunnel syndrome and duration of gadget use ($p = 0.041$).
Conclusions: This research concludes that the prevalence of carpal tunnel syndrome in students is present in 118 (48.6%) respondents. Furthermore, this research finds that there is a relationship between the occurrence of carpal tunnel syndrome in students and the duration of gadget use. However, there was no relationship between sex, body mass index, device size, and the occurrence of carpal tunnel syndrome.
Keywords : carpal tunnel syndrome, duration of gadget use, gadget

INTRODUCTION

In today's digital age, it is difficult to separate humans from engaging in communication using digital devices. People often use gadgets with the internet to exchange messages with others so that communication can be carried out faster and efficiently. Data shows that 66.3% of people in Indonesia own smartphones and more than 50% use them to communicate.[1] Now, teenagers such as students often communicate by sending short messages using their gadgets. This leads to an increase in finger movements while typing for a short period.[2] Moreover, in the digital era, students also use gadgets as media to support independent learning. Various applications and learning materials in gadgets increase the frequency of gadget use. [3,4] In addition to learning, the use of gadgets such as playing games requires the player to press the smartphone screen or keypad firmly and continuously for several minutes.[2] These repetitive movements performed by the fingers often lead to musculoskeletal disorders, including carpal tunnel syndrome (CTS).[5,6]

Carpal tunnel syndrome is the most common peripheral nerve disorder in the upper extremities.[7–9] According to a study conducted by the American Academy of Orthopedic Surgeons in 2007 in America, the prevalence of CTS in the general population is 50 cases out of 1000 people. In Mexico about 99 out of 100,000 people per year experience CTS. In the general population, the prevalence of CTS is estimated at 7% to 19%.[8] About 3.8% of people who complain of pain, irresponsiveness, and itching in their hands, have CTS and this can occur at any age.[10] In Indonesia, the prevalence of CTS remains unknown because no survey has been conducted previously.[11]

Carpal tunnel syndrome causes hand pain and can lead to disabilities, including limited functionality of the hand and wrist.[12,13] In some cases, sufferers may wake up at night due to pain and tingling sensations in their hands, which can then radiate to the shoulder.[8] Carpal tunnel syndrome can reduce productivity and negatively impact daily life. For instance, pain can be felt when holding a ballpoint pen, using chopsticks or buttoning clothes.[14,15] In severe cases, CTS must be treated by surgery.[16]

Previous studies have found a relationship between the use of gadgets for five hours per day and hand injury. If left untreated, this hand injury can progress to CTS.[17] In some studies, it was found that CTS is more common in the female sex.[8,15,16] Body mass index is also one of the risk factors for CTS because it has been found that people who are obese are more at risk of developing CTS.[8,10,16] The use of gadgets with a larger size was also found to be related to the narrowing of the carpal tunnel compared to medium or small gadgets.[18] Risk

factors for CTS include diabetes, occupational factors, genetics, hypothyroidism, sex, pregnancy, obesity, history of wrist injury, and age.[10,19,20]

Based on the description above, the author aims to find the relationship between sex, body mass index, duration of use, and gadget size with the occurrence of carpal tunnel syndrome in Bachelor of Medicine Students from Universitas Udayana.

METHODS

The research method used is an observational study with a cross-sectional analytical design. The study's subjects were 243 students selected using a purposive sampling technique. After obtaining ethical clearance, sample collection is conducted at the Faculty of Medicine, Universitas Udayana. All the participants had met the inclusion and exclusion criteria. The inclusion criteria used in this research were Bachelor of Medicine students from Universitas Udayana, batch 2021-2022, who had consented to answering a research questionnaire through an interview, and the exclusion criteria were students who are either pregnant, has a history of hand injuries or has hypothyroidism.

Data was taken in the form of interviews using questionnaires. In determining whether CTS is found, respondents are asked to fill in the Boston Carpal Tunnel Questionnaire (BCTQ). The analysis used in this research is the Chi-Square test with a significance level of $\alpha = 0.05$.

RESULTS

Based on the data obtained, there were 243 respondents willing to become research participants. The data obtained were then processed using descriptive analysis and can be seen in **Table 1.** The results of the data analysis showed that 118 (48.6%) respondents met the criteria for diagnosing carpal tunnel syndrome. Based on sex, there were 160 (65.8%) respondents who were female, and among them were 83 (51.9%) respondents who experienced carpal tunnel syndrome. Male respondents amounted to 83 (34.2%) respondents, and among them there were 35 (42.1%) respondents who experienced carpal tunnel syndrome.

Based on body mass index (BMI), 14 (5.8%) respondents were obese, and 8 (57.1%) of them had carpal tunnel syndrome. It was also obtained that 229 (94.2%) respondents were not obese, and among them, 110 (48%) respondents experienced carpal tunnel syndrome.

Based on the duration of device use, respondents who used gadgets with a duration of ≥ 5 hours were obtained as many as 220 (90.5%) respondents, and among them, 112 (50.9%) respondents experienced carpal tunnel syndrome. On the other hand, only 23 (9.6%) respondents and 6 (26.1%) respondents who used a device < 5 hours experienced carpal tunnel syndrome.

Based on device size, respondents who used large device sizes were 89 (36.6%) respondents and 51 (57.3%) respondents among them who experienced carpal tunnel syndrome. In contrast, there are 154 (63.4%) respondents using a device size that is not large. Among them, 67 (43.5%) respondents experienced carpal tunnel syndrome.

Table 1. Prevalence of carpal tunnel syndrome among Bachelor of Medicine Students from Universitas Udayana, batch 2021-2022

Variables	Total n (%)	CTS Prevalence n (%)
Gender		
Female	160 (65,8)	83 (51,9)
Male	83 (34,2)	35 (42,1)
Body Mass Index (BMI)		
Obese (≥ 30.0)	14 (5,8)	8 (57,1)
Not Obese (<30.0),	229 (94,2)	110 (48)
Duration of gadget use		
≥ 5 hours	220 (90,5)	112 (50,9)
< 5 hours	23 (9,6)	6 (26,1)
Gadget size (based on width)		
Large (> 12,7 cm)	89 (36,6)	51 (57,3)
Not Large (≤ 12,7 cm)	154 (63,4)	67 (43,5)
Total	243 (100)	118 (48,5)

CTS: Carpal Tunnel Syndrome

DISCUSSION

This research was attended by 243 respondents who were willing to answer questions through interviews with questionnaires. The results showed that as many as 118 (48.6%) respondents met the diagnosis criteria and 125 (51.4%) respondents did not meet the CTS diagnosis criteria. This is corresponding with research conducted by Zaher[21] on medical students at Faisal University, Saudi Arabia. In the study, 130 (40.7%) respondents were obtained out of a total of 319 respondents who experienced CTS symptoms. This happens because the workload of medical students is categorized as heavier, so it requires the use of gadgets for a longer duration.[21]

Table 2. Chi Square test result of factors associated with carpal tunnel syndrome

Variables	*Carpal Tunnel Syndrome*		Total n (%)	*p value*
	Yes n (%)	No n (%)		
Gender				
Female	83 (34,2)	77 (31,7)	160 (65,8)	0,193
Male	35 (14,4)	48 (19,8)	83 (34,2)	
Body Mass Index (BMI)				
Obese (≥ 30.0),	8 (3,3)	6 (2,5)	14 (5,8)	0,699
Not Obese (< 30.0),	110 (45,3)	119 (49)	229 (94,2)	
Duration of gadget use				
≥ 5 hours	112 (46,1)	108 (44,4)	220 (90,5)	0,041*
< 5 hours	6 (2,5)	17 (7)	23 (9,5)	
Gadget size (based on width)				
Large (> 12,7 cm)	51 (43,2)	38 (42,7)	89 (36,6)	0,052
Not Large (≤ 12,7 cm)	67 (27,6)	87 (35,8)	154 (63,4)	
Total	118 (48,6)	125 (51,4)	243 (100)	

**p value* < 0.05 means statistically significant

Based on **Table 2.** above the results of chi square statistical test shown that the variable of the duration of gadget use had a significant relationship (p = 0.041) with the occurrence of carpal tunnel syndrome.

Sex Relationship with Carpal Tunnel Syndrome Occurrence

Data shows that based on sex, CTS is more prevalent in 83 (51.9%) female respondents, as compared to 35 (42.1%) male respondents. This result is corresponds with Al Shahrani's research[22] that female is found to be two to three times more at risk of developing CTS than male. This can occur due to differences in wrist anthropometry owned by male and female.[22] However, the results of the Chi-Square test related to sex and the occurrence of CTS can be seen in **Table 2** showed a value of p = 0.193 , which means that sex did not have a significant relationship with the occurrence of CTS.

This is distinguishable from the research conducted by Mitake[23] which found female sex as one of the risk factors for CTS. In the study, it was found that the occurrence of CTS was higher in female, especially those who experienced menopause due to hormonal changes. In this research, the absence of a relationship between sex and the occurrence of CTS could be caused by the age difference of the study subjects who were still classified as young adults, while the risk of CTS increased with age.[8,23]

Relationship Between Body Mass Index and Carpal Tunnel Syndrome Occurrence

In this research, the occurrence of CTS was experienced by 8 (57.1%) obese respondents and 110 (48%) non-obese respondents. This result contrasts with Zaher's study[21] which found more CTS occurrences in obese respondents. This occurs because the body mass index (≥ 30.0), which is categorized as obesity, is one of the risk factors for the occurrence of CTS.[21] In this research, it was found that there were fewer obese respondents than those not obese. This discrepancy can be attributed to the differences in the characteristics of the samples used.

The results of the Chi-Square test can be seen in **Table 2** showed p = 0.699 which means there was no significant association between BMI and CTS occurrence. This contrasts with earlier studies that stated that there was a significant relationship between BMI (≥ 30.0) which is categorized as obesity and the occurrence CTS. In the study, the high BMI rate classified as obesity caused the enlargement of fat tissue which narrowed and increased the hydrostatic pressure of the carpal tunnel thereby increasing the risk of CTS.[24,25]

However, this is corresponds with research conducted by Adebayo[26], which states that high BMI does not have a significant relationship with CTS. This research states that there is a higher frequency of CTS in people with a BMI over 30, but the BMI is a factor that cannot stand alone because it is still influenced by age and sex.[26] In this research, no relationship between BMI and CTS occurrence was found. This can be due to differences in the characteristics of the sample used and hardly any obese respondents.

Relationship Between the Duration of Gadget Use and Carpal Tunnel Syndrome Occurrence

In this research, the results of the Chi-Square test can be seen in **Table 2** showed p = 0.041, which means that there is a significant relationship between the duration of gadget use and the occurrence of CTS. Data showed that CTS events were experienced by 112 (50.9%) respondents who used gadgets with a duration of ≥ 5 hours and 6 (26.1%) respondents who used gadgets with a duration of < 5 hours. The results of this research are corresponding with research conducted by Al Shahrani[22], which states that the use of gadgets with a duration of ≥ 5 hours a day has a relationship with the occurrence of CTS. The use of gadgets for 5 hours a day or more can cause changes in the median nerve and carpal tunnel, increasing the risk of CTS. Excessive use of gadgets is also said to affect the flexor tendons, pollicis longus, and median nerve, which causes pain in the thumb area and decreases hand function.[22]

Another study conducted on a group of students showed that excessive use of gadgets can lead to enlargement of the median nerve, which can then increase the risk of CTS. The young adult population is more susceptible to musculoskeletal

disorders because they use gadgets more often. Therefore, hand movements when typing quickly for a long duration can affect the occurrence of CTS.[27] This result is also corresponded with research conducted by Lai[2], which states that intensive use of gadgets such as smartphones at a young age can increase the risk of CTS.

Relationship Between Gadget Size and Carpal Tunnel Syndrome Occurrence

CTS incidents were experienced by 51 (57.3%) respondents who had a large gadget size and 67 (43.5%) respondents who had a not large gadget size. The size of the gadget showed insignificant results for the occurrence of CTS with $p = 0.052$ can be seen in **Table 2**, which means that there was no relationship between large gadgets and CTS. This result is contrary to research conducted by Fridayani[18] which states that a larger device size can cause disturbances in the median nerve due to narrowing of the carpal tunnel, thereby increasing the risk of CTS.

This is due to the size and weight of the gadget, which affects the degree of pressure exerted on the gadget. This would then the narrowing of the carpal tunnel. In addition, the difference in device size also gives a different effect on how to hold, use, or swipe for each user. The larger the device, the more emphasis the thumb needs to make on the device when typing. Large devices can also cause discomfort because they do not match the hand ergonomics.[18] In this research, no relationship was found between the size of the gadget and the occurrence of CTS. This can be caused by differences in hand posture used when using gadgets, variations in gadget use in respondents who have more than one gadget, and differences in how to diagnose carpal tunnel syndrome.

CONCLUSIONS AND SUGGESTIONS

In this research, 118 (48.6%) prevalence of carpal tunnel syndrome were obtained in Bachelor of Medicine students, Universitas Udayana, batch 2021-2022. There is a relationship between the duration of use and the occurrence of carpal tunnel syndrome experienced by students. However, there was no relationship between sex, body mass index, gadget size, and the occurrence of carpal tunnel syndrome experienced by students.

It is recommended for students to rest if they have used a gadget for a duration of ≥ 5 hours, reducing the risk of carpal tunnel syndrome. Future researchers are advised to investigate other risk factors for carpal tunnel syndrome, such as hand posture. Standardized physical examinations can be used when researching, making the results obtained when diagnosing carpal tunnel syndrome can be more objective.

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