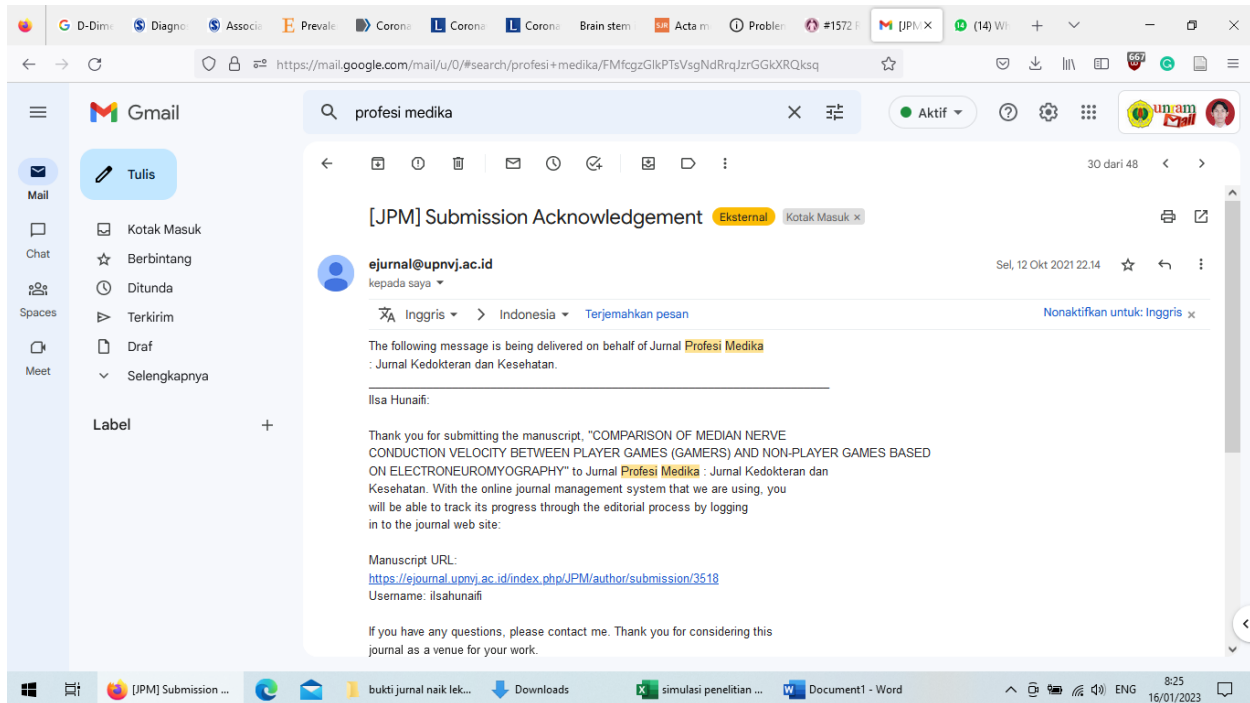


## Judul Artikel

"COMPARISON OF MEDIAN NERVE CONDUCTION VELOCITY BETWEEN PLAYER GAMES (GAMERS) AND NON-PLAYER GAMES BASED ON ELECTRONEUROMYOGRAPHY".

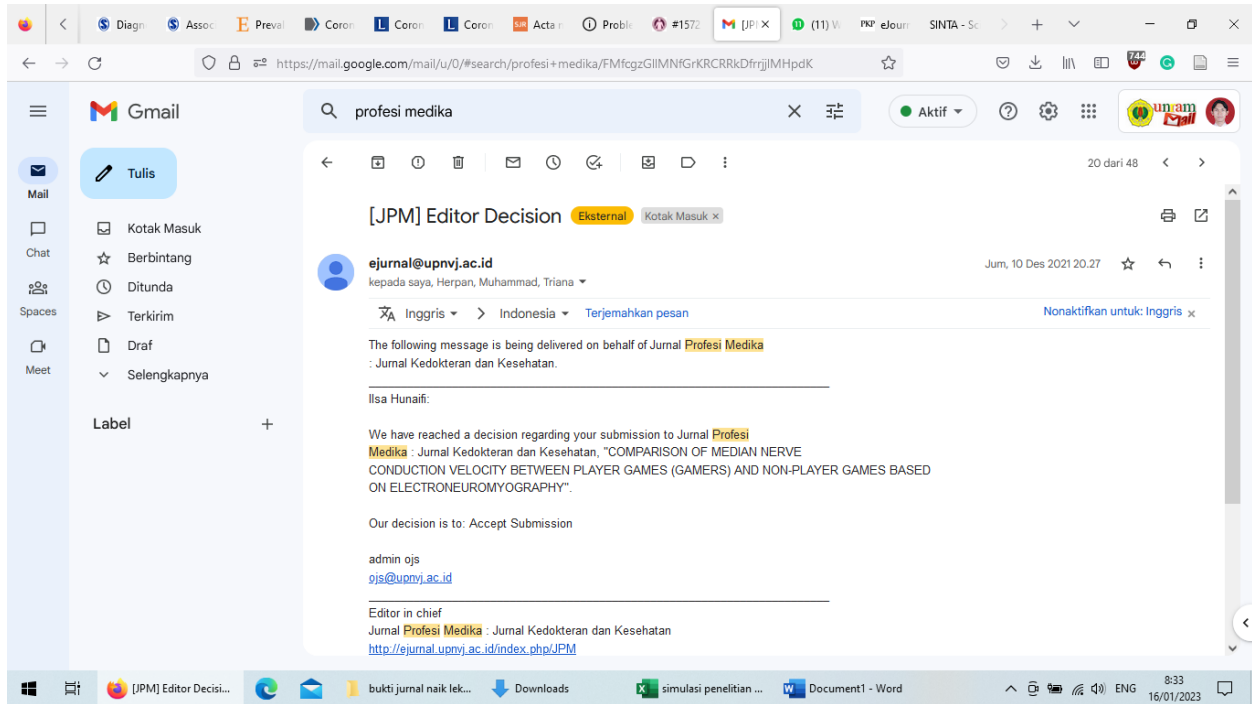
## Gambar 1. Submit Artikel



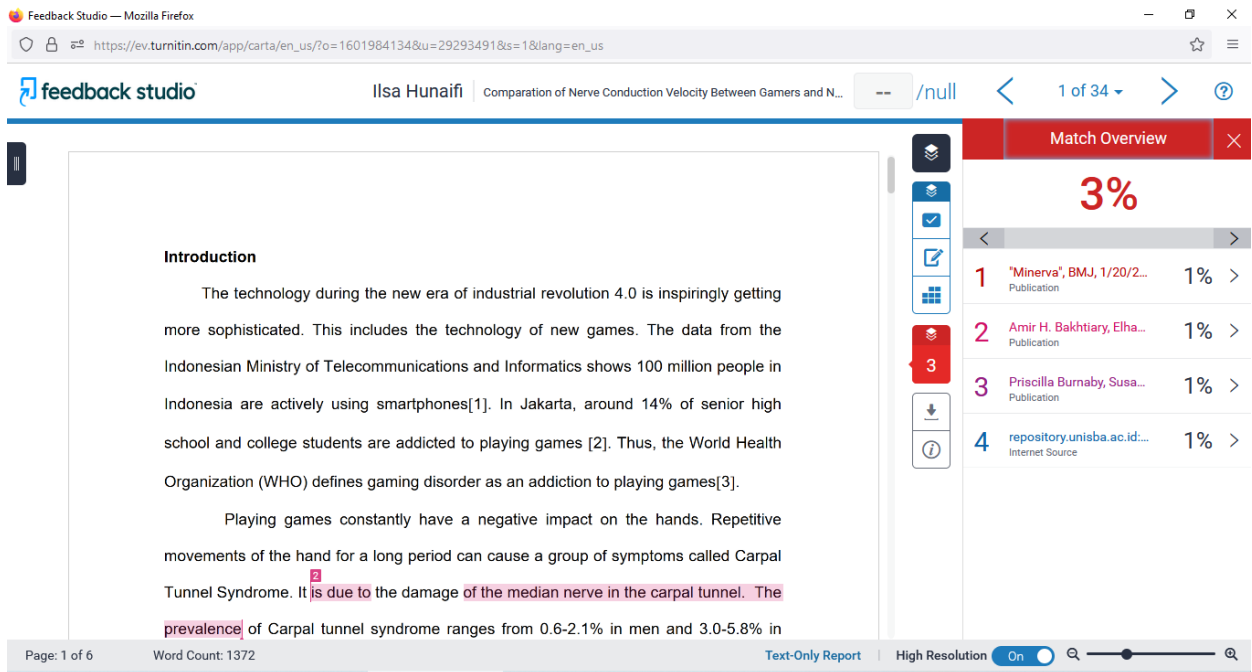
## Gambar 2. Revisi Artikel

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Gambar 3. Penerimaan publikasi



Gambar 4. Plagiarism dari Turnitin



## COMPARISON OF MEDIAN NERVE CONDUCTION VELOCITY BETWEEN PLAYER GAMES (GAMERS) AND NON-PLAYER GAMES BASED ON ELECTRONEUROMYOGRAPHY

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### ABSTRACT

Playing games for a long period can induce a negative effect on the hands especially on median nerve. The purpose of this study is compared of median nerve conduction between gamers and non-gamers. This study was analyzed with cross sectional method of 40 subject at University Mataram Hospital from September to October 2020. The subjects included gamers and non-gamers subjects as controls. All groups was tested the median nerve conduction velocity using Electromyoneurography. Demographic data was analyzed with descriptive and compare median nerve conduction study between two groups with the *Mann Whitney* test. Each group obtained 20 subjects. The mean median motor nerve conduction velocity on the right side of gamers and non-gamers is  $2.83 \pm 1.2$  ms and  $2.44 \pm 1.2$  ms, while the left side is  $2.9 \pm 1.0$  ms and  $2.5 \pm 1.1$  ms. The mean sensory median nerve conduction velocity on the right side of gamers and non-gamers is  $2.31 \pm 1.02$  ms and  $2.25 \pm 0.88$  ms, the left side is  $2.4 \pm 1.1$  ms and  $2.25 \pm 0.9$  ms. The Mann Whitney test **used to compare both motor and sensory**, showed no significant difference between the two groups ( $p > 0.05$ ).

**Keywords:** Gamers, Nerve Conduction Velocity, Median Nerve

### INTRODUCTION

Technology during the new era of industrial revolution 4.0 is getting inspiringly more sophisticated. This includes the technology of new games. The data from the Indonesian Ministry of Telecommunications and Informatics show 100 million people in Indonesia are actively using smartphones.<sup>1</sup> In Jakarta, around 14% of senior high school and college students are addicted to playing games.<sup>2</sup> In United States (US), adult will spend an average of 3 hours, 35 minutes/day on mobile device in 2018 and increase 11 minutes in 2019.<sup>3</sup> Thus, the World Health Organization (WHO) defines gaming disorder as an addiction to playing games.<sup>4</sup>

Constant game playing has negative impacts on the hands. Repetitive movements of the hand for a long period can cause a group of symptoms called Carpal Tunnel Syndrome (CTS). CTS is the most common neuropathy of the upper limb and studies

on CTS relationship with biomechanical exposure at work.<sup>5</sup> It is due to the damage of the median nerve in the carpal tunnel. The prevalence of Carpal tunnel syndrome ranges from 0.6% - 2.1% in men and 3.0% - 5.8% in women. This prevalence is mostly found among office workers because they work repetitively using keyboard and mouse. The damage to the median nerve will lead to several symptoms such as pain and tingling sensation on the 1<sup>st</sup> - 3<sup>rd</sup> fingers.<sup>6</sup>

The damage of the median nerve occurs due to repetitive movements and pressure to the nerve. Repetitive movements such as typing on a smartphone or playing games will lead to this condition. The use of electronic devices for more than 3 hours per day results in musculoskeletal problems. Besides, repetitive flexion and extension of the wrist can trigger repeated trauma leading to carpal tunnel syndrome which is caused by the increased volume or the decreased size of

the carpal tunnel.<sup>7</sup> To establish the difference in median nerve conduction velocity among game players and non-players, research should be conducted to reveal whether playing games will cause a direct impact on the damage of the median nerve. This study aims to determine the difference of conduction velocity of the median nerve between gamers and non-gamers.

## MATERIAL AND METHODS

This research is an analytical observational study with a cross-sectional method. The subjects include game players who play using computers, tablets, smartphones, or video game consoles and non-players who serve as control. The inclusion criteria include game players who had been playing games for at least 5 hours per day in a year minimally. These subjects were between 17 to 45 years old. The subjects were excluded if they had experienced wrist injury or hand surgery and/or suffered from diabetes, obesity, thyroid disease, rheumatoid arthritis, or previous Carpal Tunnel Syndrome.

All subjects were screened by using Kamath and Stothard's Carpal Tunnel

Questionnaire (CTQ) and then divided into 2 groups. All participants were checked using Electroneuromyography. The research data were taken from September to October 2020 at The University Mataram Hospital. This research was approved by The Ethics dan Research Commission Medical Faculty University of Mataram no 100/UN18.F7/ETIK/2020. The collected data were analyzed using SPSS IBM version 26. The subjects' characteristics were analyzed descriptively using means and percentages. This study used *Mann Whitney* test to compare between motor and sensory median nerve in terms of its conduction velocity

## RESULT

The total number of the subjects was 40 people, consisting of 20 men and 20 women. The mean score of the screening results for gamers was  $2.35 \pm 1.5$ . Based on the age, the mean age was  $21.75 \pm 1.63$  years old. Specifically, the mean age was  $21.6 \pm 1.85$  years for the gamers and  $21.9 \pm 1.41$  years old for the non-gamers. The average time of playing games in a year was  $2.25 \pm 0.84$  years with the average duration of  $5.85 \pm 1.2$  hours (**table 1**).

**Table 1.** Basic Characteristic of Subject

	Subject Category		<i>p</i>
	Gamers	Non-Gamers	
Age (year old)	$21.75 \pm 1.63$	$21.9 \pm 1.41$	0.214
Gender			
Female	4 (20%)	16 (80%)	0.001
Male	16 (80%)	4 (20%)	
Work status			
Students	19	19	0.731
Officer	1	1	
Playing duration (hours)	$\geq 5$ hours	$< 5$ hours	0.000

The results of the Median Nerve Conduction Velocity (NCV) examination in the gamers group showed the average of right motor NCV was  $2.83 \pm 1.2$  ms while

the average of right motor NCV in non-gamers was  $2.44 \pm 1.2$  ms. The mean of left motor NCV of the median nerve for gamers was  $2.9 \pm 1.0$  ms and  $2.5 \pm 1.1$  ms for non-

gamer. Moreover, the mean of right median sensory NCV for gamers and non-gamers was  $2.31 \pm 1.02$  ms and  $2.25 \pm 0.88$  ms,

respectively. The mean of left sensory NCV for gamers and non-gamers was  $2.4 \pm 1.1$  ms and  $2.25 \pm 0.9$  ms, respectively (table 2).

**Table 2** Median Nerve Conduction Velocity (NCV)

	Median Nerve Conduction Velocity		<i>p</i>
	Gamers	Non-Gamers	
Right Motor Median Nerve Conduction Velocity	$2.83 \pm 1.2$	$2.44 \pm 1.2$	0.187
Left Motor Median Nerve Conduction Velocity	$2.9 \pm 1.0$	$2.5 \pm 1.1$	0.097
Right Sensory Median Nerve Conduction Velocity	$2.31 \pm 1.02$	$2.25 \pm 0.88$	0.341
Left Sensory Median Nerve Conduction Velocity	$2.4 \pm 1.1$	$2.25 \pm 0.9$	0.207

\*Mann Whitney Test

## DISCUSSION

This study involved 40 subjects with the mean age of the gamers group is  $21.75 \pm 1.63$  years and  $21.9 \pm 1.41$  years for non-gamers. This finding is consistent with the epidemiological data done by the Decision Lab which shows the percentages of each age group. Based on the data, 25 percent of the population is between 16-24 years old, 27 percent of the population is among 25-34 years old, and 17 percent is between 45-54 years old.<sup>8</sup> In the United States, there are 20 percent of gamers being under 18 years old and 38 percent of gamers being 18-34 years old. In addition, there is 14 percent of gamers being 34-54 years old and 9 percent being 55-64 years old. Lastly, 7 percent of game player are more than 65 years old.<sup>9</sup>

In this study, the number of men and women is equal. The data obtained by the Decision Lab shows 49 percent of gamers in Indonesia are male while 51% percent of gamers are female.<sup>8</sup> In the United States, female game users have increased significantly from 38% in 2006 to 46% in 2019.<sup>9</sup>

The use of electronic devices for more than 5 hours a day can cause enlargement and swelling of the carpal tunnel and is related to the degree and duration of pain complaints in the hands.<sup>7</sup> In this study, there

was a significant difference between subjects who played games for more than 5 hours and less than 5 hours (table 1). This shows that the length of playing games can affect whether there are complaints or not in the research subjects. The Risk of CTS is increased with use a computer especially use a mouse for more than 20 hours.<sup>10</sup>

The purpose of this study was to see the difference in the speed of delivery of the median nerve both motor and sensory in gamers and non-gamers. According to the test results, it was found that motor and sensory nerve conduction velocity in both right and left hands between the gamers and non-gamers did not differ significantly. This is probably due to several aspects, such as age and gender between the two groups being relatively equal. Research conducted by Yusel et al, 2005, showed that the electroneuromyography examination of the median nerve in mouse users compared to the control group was not significantly different.<sup>11</sup> Electroneuromyography examination in mild cases of CTS could not be applied due to the presence of symptoms but the electroneuromyography result is normal.<sup>12</sup> Ultrasound examination and Phalen's test, as a test to detect the presence of CTS in excessive smartphone users,

showed no significant differences between those who used smartphones <12 months and other groups (> 12 - 24 months and the group > 24 months). According to the analysis of smartphone use duration between <3 hours, 3-7 hours and more than 8 hours, the Phalen's test showed a significant difference among three groups. However, the results based on ultrasound examination showed otherwise.<sup>13</sup> Cunha et al reported that electroneuromyography has 92.3% sensitivity, 81,8% specificity, and the Phalen test showed same result with electroneuromyography especially in the most severe and mild cases.<sup>14</sup>

This study has several limitations. First of all, the electroneuromyography examination was only carried out once. Second, the Carpal Tunnel Questionnaire screening did not find any abnormalities among the young adult population in this study. Long-term research is needed to determine the impact of games on the median nerve and compare using ultrasonography.

## CONCLUSION

The duration of the use of electronic games can result in alteration of median nerve velocity although statistically doesn't show any difference between gamers and non-gamers.

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