

## Duration of Playing Mobile Legends Online Games and Its Association with the Incidence of De Quervain Syndrome Among Adolescents at SMAN 2 Denpasar

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### Abstract

**Introduction:** Playing Mobile Legends involves repetitive finger activities that increase the risk of injuries, such as De Quervain Syndrome (DQS). This study examines the association between the duration of gaming and the incidence of DQS among adolescents.

**Methods:** A cross-sectional design was employed with 66 male students from SMAN 2 Denpasar selected through purposive sampling. Data on gaming duration were collected using questionnaires and smartphone logs. DQS was assessed using the Finkelstein test and a Visual Analog Scale (VAS). Spearman's rho test was used for analysis.

**Results:** A significant association was found between gaming duration and the incidence of DQS ( $p=0.009$ ,  $r=0.319$ ), indicating a moderate correlation. Most students playing for over 7 hours daily tested positive on the Finkelstein test.

**Conclusion:** Prolonged gaming duration increases the risk of DQS. Education on time management and thumb stretching exercises can help prevent this injury.

**Keywords:** de Quervain syndrome, gaming duration, Mobile Legends, repetitive strain injury (RSI), adolescents

### Introduction

In the digital era, the internet has become essential for daily activities. This growing dependence is driven by the accessibility of vast information that meets the public's needs and desires. The internet serves as a medium for social interaction on social media, accessing remote shopping services, completing school assignments, expanding knowledge in digital creativity, and providing entertainment such as music streaming, video streaming, and online gaming.

Today's adolescents are a generation growing up alongside rapid technological advancements. They are often referred to as the most tech-savvy generation. According to a study conducted by Resti, the highest percentage of smartphone usage was observed among adolescents, accounting for 39% within the age range of 16 to 21 years.<sup>1</sup> Adolescents represent the age group most commonly associated with issues related to technology use, one of the most prevalent being online gaming.<sup>2</sup>

Multiple users can access and play online games using an internet connection. These games come in various genres, including RPG (Role-Playing Game), puzzle, and MOBA (Multiplayer Online Battle Arena). Among these, MOBA games are top-rated among adolescents today.<sup>3</sup> Mobile Legends, commonly abbreviated as ML, is a MOBA-type online game among the most widely played today. According to data from the Google Play Store, Mobile Legends has been downloaded and played by over 100 million users.

Adolescents often spend more than 2 hours per day playing online games, exceeding 14 hours per week, with some spending as much as 55 hours weekly or an average of 20–25 hours per week.<sup>4</sup> A study conducted by Jap et al. reported that approximately 10.15% of adolescents in Indonesia are at risk of developing online gaming addiction.<sup>5</sup> This addiction leads to increased thumb activity during online gaming. The heightened activity poses a risk of causing Repetitive Strain Injury (RSI) in the hands and wrists of users. RSI refers to disorders affecting muscles, tendons, or nerves, primarily caused by repetitive and continuous movements.<sup>6</sup>

Repetitive injuries, such as De Quervain Syndrome, are commonly found in populations that engage in repetitive hand activities over extended periods, such as typing, playing musical instruments, or gaming on smartphones. This injury is exacerbated by specific movements, such as repeated thumb abduction, one of the primary motions involved in playing Mobile Legends.<sup>7</sup>

De Quervain Syndrome (DQS) is a type of Repetitive Strain Injury (RSI) that involves the continuous and prolonged use of the thumb. DQS occurs at the carpometacarpal joint and first metacarpal. Also known as De Quervain Tenosynovitis, this syndrome is caused by inflammation, trauma, or excessive strain on the tendons of the extensor pollicis brevis and abductor pollicis longus muscles. Common triggers include excessive and repetitive wrist movements or overuse of the thumb.<sup>7</sup> Engaging in online gaming activities such as Mobile Legends by adolescents who are addicted

can indirectly increase the risk of developing De Quervain Syndrome.<sup>8</sup> Globally, the prevalence of injuries related to electronic device use has risen with the growing popularity of smartphone-based games. These injuries, including DQS, are often undiagnosed until chronic symptoms appear.<sup>7</sup>

There have been several studies on the duration of online gaming and the incidence of De Quervain Syndrome in Indonesia. However, no research has specifically examined the relationship between the duration of playing Mobile Legends and the occurrence of De Quervain Syndrome in adolescents, focusing on one gender, specifically male adolescents. The selection of male adolescents as the sample is based on the fact that they are at a higher risk of developing De Quervain Syndrome than females due to their higher interest in online gaming. Similar studies have yet to be conducted in high schools in Denpasar.

Therefore, this study aims to investigate the relationship between the duration of playing Mobile Legends and the incidence of De Quervain Syndrome among male students at SMAN 2 Denpasar. It is hypothesized that the longer the duration of playing Mobile Legends, the higher the risk of developing De Quervain Syndrome. This research is expected to serve as a reference or guide to better understanding De Quervain Syndrome's risk factors and raise awareness among adolescents about managing online gaming duration.

## Methods

This study uses a cross-sectional approach, which involves measuring or observing the independent and dependent variables at a single point in time. The independent variable in this study is the duration of playing online games, while the dependent variable is the occurrence of De Quervain Syndrome. The study was conducted in September 2024 at SMAN 2 Denpasar. The sampling technique used is purposive sampling, where samples are selected based on specific considerations to ensure the data is representative of the population. Sixty-six male students from SMAN 2 Denpasar were included as the sample.

The inclusion criteria for this study were male adolescents aged 15-18 who played the online game Mobile Legends and voluntarily agreed to participate from start to finish. The exclusion criteria were a history of trauma resulting in thumb pain and withdrawal or refusal to participate in the study.

The study began by gathering student names from the school's administrative head (Kepala TU). The researcher then contacted the class presidents through the student council (OSIS) to distribute a Google Forms link, which included questions about the inclusion and exclusion criteria. After the sample was obtained based on the inclusion and exclusion criteria, the participants were gathered on a specific day to conduct the research.

The inclusion criteria were male students aged 15-18 years, without a history of thumb trauma, and who agreed to participate fully. The duration of online gaming was confirmed using smartphone app usage records to reduce self-report bias. To address selection bias, all students who met the criteria were invited to participate. Incomplete data were excluded from the final analysis.

Online gaming duration was measured using a questionnaire asking participants how many hours they played online games daily. Additionally, duration was directly measured through each participant's smartphone, which recorded the total hours spent using the Mobile Legends app. The results were then categorized into three groups: low duration (<2 hours/day), moderate duration (2-7 hours/day), and high duration (>7 hours/day).

The presence of De Quervain Syndrome was assessed using the Finkelstein test. The Finkelstein test is a valid diagnostic tool often used to detect De Quervain Syndrome, with a reported sensitivity of 88%. This passive test involves flexing the thumb to touch the palm, then flexing the other four fingers into a fist with the thumb inside, followed by passive ulnar deviation of the wrist. A positive result is indicated by pain around the distal radius. Pain intensity was measured using the Visual Analog Scale (VAS), where 0-1: no pain, 1-3: mild pain, 3-7: moderate pain, 7-9: severe pain, and 9-10: severe pain.

The sample size (n=66) was determined based on a minimum of 10 subjects per variable, calculated using a simple correlation formula with a 5% margin of error and 80% test power. Data from incomplete participants or those who withdrew were excluded from the analysis, reducing the sample size from 72 to 66 subjects.

The collected data were then analyzed using SPSS version 26.0. Univariate analysis was performed to describe the subjects' general characteristics based on age, duration of online gaming, pain intensity, and the occurrence of De Quervain Syndrome. Both variables were treated as ordinal scales, divided into categories with different levels. Thus, bivariate analysis using Spearman's rho was used to examine the relationship between the duration of playing Mobile Legends and the occurrence of De Quervain Syndrome. A p-value of <0.01 indicated a significant relationship, while a p-value of >0.01 indicated no significant relationship between the variables.

## Results

The subjects of this study were 66 male students from SMAN 2 Denpasar, selected based on the sampling procedure outlined in Figure 1.

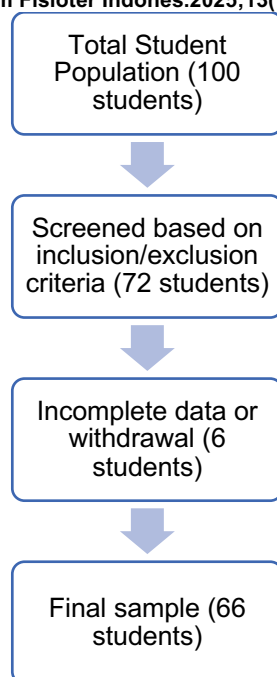


Figure 1. Flowchart

The study's subjects were characterized using univariate analysis based on age, duration of playing Mobile Legends, pain intensity, and the results of De Quervain Syndrome examinations. The frequency distribution of these characteristics is shown in Table 1.

| Variable                        | Frequency (n) | Percentage (%) |
|---------------------------------|---------------|----------------|
| Age                             |               |                |
| 15                              | 44            | 66.7           |
| 16                              | 13            | 19.7           |
| 17                              | 9             | 13.6           |
| Duration of Mobile Legends Play |               |                |
| Low (<2 hours/day)              | 24            | 36.4           |
| Moderate (2-7 hours/day)        | 40            | 60.6           |
| High (>7 hours/day)             | 2             | 3.0            |
| Pain Intensity (VAS Scale)      |               |                |
| No pain: 0-1                    | 23            | 34.8           |
| Mild pain: 1-3                  | 15            | 22.7           |
| Moderate pain: 3-7              | 27            | 40.9           |
| Severe pain: 7-9                | 1             | 1.5            |
| De Quervain Syndrome            |               |                |
| Positive                        | 43            | 65.2           |
| Negative                        | 23            | 34.8           |

Based on Table 1, it can be seen that out of the 66 student samples, the highest frequency is observed in the 15-year-old group, with 44 students (66.7%). Regarding the duration of online games, most students play for an average of 2-7 hours per day, totaling 40 students (60.6%). Regarding the intensity of pain experienced, most students reported moderate pain, with 27 students (40.9%) and only one student (1.5%) experiencing severe pain. As for the occurrence of De Quervain syndrome, 43 students (65.2%) tested positive for the condition. The results of the correlation test between the duration of playing online games and the occurrence of De Quervain syndrome are presented in Table 2.

| Correlation                                                  | Spearman's Rho (r) | p-value |
|--------------------------------------------------------------|--------------------|---------|
| Duration of playing Mobile Legends with De Quervain Syndrome | 0.319              | 0.009   |

Based on Table 2, the p-value of 0.009 ( $p < 0.01$ ) indicates a significant relationship between the two variables: the duration of playing the Mobile Legends online game and the occurrence of De Quervain Syndrome in students at SMAN 2 Denpasar. A positive correlation coefficient of 0.319 was obtained, indicating a moderate correlation in the same direction. This means that the longer a person plays Mobile Legends, the higher their risk of developing De Quervain Syndrome. The relationship between the duration of playing Mobile Legends and the occurrence of De Quervain Syndrome (DQS) is shown in Table 3.

**Table 3.** The relationship between the duration of playing Mobile Legends and the occurrence of De Quervain Syndrome (DQS)

| Duration of Playing | Positive DQS (n) | Negative DQS (n) | Total (n) | Percentage of Positive DQS (%) |
|---------------------|------------------|------------------|-----------|--------------------------------|
| < 2 hours/day       | 12               | 12               | 24        | 50.0%                          |
| 2-7 hours/day       | 29               | 11               | 40        | 72.5%                          |
| > 7 hours/day       | 2                | 0                | 2         | 100.0%                         |
| Total               | 43               | 23               | 66        | -                              |

The analysis of the relationship between the duration of playing Mobile Legends and the occurrence of De Quervain Syndrome (DQS) shows that the longer the playing duration, the higher the risk of developing DQS. In the group playing less than 2 hours per day, out of 24 students, 12 students (50%) were positive for DQS, while the rest were harmful. In the group playing 2–7 hours per day, out of 40 students, the majority, 29 students (72.5%), were positive for DQS, while 11 were negative. The group with the highest playing duration, more than 7 hours per day, showed the highest risk, with all two students (100%) testing positive for DQS.

## Discussion

### Characteristics of the Study Subjects

This study was conducted at SMA Negeri 2 Denpasar, with the sample consisting of adolescent students who played the online game Mobile Legends on their smartphones. The sample was selected using purposive sampling, considering the inclusion and exclusion criteria that had been established. The initial sample size consisted of 72 students who played Mobile Legends. However, 2 participants were excluded due to a history of trauma that caused pain in the thumb area. From the remaining 70 participants, 66 students were selected, which was the required sample size for this study. The research subjects were gathered on the same day for the data collection.

This study's most common age group was 15 years old, with 44 students. This was followed by 13 students aged 16 and 9 students aged 17. A survey by Ripa'i et al. showed that smartphone usage duration increases in late adolescence due to rapid technological development and high adolescent curiosity. This is supported by data from the Smart Data platform, which released information about the Smartphone User Personal Report (SUPR) in Indonesia, showing that the highest percentage of smartphone users were in the age group below 30, with approximately 61% of users in 2015.<sup>9</sup> A study by Afkan et al. showed that there is a relationship between age and the occurrence of de Quervain syndrome, with a sample of Mobile Legends Bang Bang players at the Institute of Technology and Science NU Pekalongan.<sup>10</sup> This finding is supported by previous research that states age is related to de Quervain syndrome because adolescents aged 16-21 often use smartphones excessively.<sup>11</sup>

In this study, the sample consisted of male adolescent participants. Male gender was chosen because male adolescents are at a higher risk of developing de Quervain syndrome compared to female adolescents. This is related to the higher interest that male adolescents have in online games compared to their female counterparts. This is in line with the statement by Griffiths et al., who reported that 81% of online gamers are male. Griffiths et al. also stated that gamers in the adolescent age group are predominantly male.<sup>12</sup> This is also supported by previous research, which explains that online gaming is more commonly found among male adolescents than females, and the likelihood of addiction to online gaming is higher in the male group compared to females.<sup>13</sup>

Based on the study's results, out of 66 samples from students at SMA Negeri 2 Denpasar, the majority fell into the moderate category, playing the game for 2-7 hours per day, with 40 students. This finding is also supported by research conducted by Pradnyadewi et al., which found that among 150 e-sport or online game players, the majority were in the moderate playing duration category (regular players, 2-7 hours per day), with 134 samples (89.3%).<sup>14</sup> The result is also consistent with previous studies showing that most online game players play for a moderate duration, typically around 2-7 hours per day.<sup>15</sup>

This study found that most of the 66 student samples experienced moderate pain, with 27 students reporting this intensity. Additionally, 15 students experienced mild pain, and only one reported severe pain in their hands. The pain intensity levels were then categorized as positive or negative for de Quervain syndrome, based on the Finkelstein test and pain measurement using the Visual Analogue Scale (VAS). The results revealed that more students tested positive for de Quervain syndrome, with 43 students (65.2%) showing positive results, while 23 students (34.8%) were negative for de Quervain syndrome. These findings are consistent with research by Pratama, which reported similar results, where most respondents (62.5%) experienced positive symptoms of de Quervain syndrome, such as tingling, cramping, and pain during physical examination. In contrast, only 37.5% of the respondents did not experience any symptoms, indicating negative de Quervain syndrome.<sup>16</sup> Another study with similar results is the research conducted by Afkan. Afkan's study found that out % of 53 respondents, 72% tested positive for de Quervain syndrome, while the remaining 28% were negative for de Quervain syndrome.<sup>10</sup>

### The Relationship Between the Occurrence of De Quervain Syndrome and the Duration of Playing Online Games Mobile Legends

The analysis of the relationship between the duration of playing online games and the occurrence of de Quervain syndrome in this study showed a p-value of 0.009, indicating a significant positive correlation with a moderate strength between the duration of playing Mobile Legends and the occurrence of de Quervain syndrome among students at SMA Negeri 2 Denpasar. These findings are consistent with the research conducted by Pradnyadewi, which reported a p-value of 0.001, suggesting a significant relationship between the duration of playing Mobile Legends and the occurrence of de Quervain syndrome among e-sport players in Denpasar.<sup>14</sup> Another study with similar findings is the research conducted by Pratama, which found a p-value of 0.00 ( $p < 0.01$ ) and a correlation coefficient of 0.836, indicating a solid

relationship between the duration of playing online games and the occurrence of de Quervain syndrome in the online gaming community in Yogyakarta.<sup>16</sup> Another study by Afkan et al., involving adolescent samples, also showed similar results, with a p-value of 0.037, indicating a relationship between the duration of playing online games and the occurrence of de Quervain syndrome.<sup>10</sup>

The results of this study support the findings of Pratama et al. (2023), which indicated a significant relationship between the duration of game playing and the risk of de Quervain syndrome (DQS) among online game players in Yogyakarta. The low correlation found ( $r=0.319$ ) may be attributed to variations in age or the intensity of activities outside of game playing, which were not measured in this study.

The findings show an increase in the prevalence of DQS as the duration of play increases. The group with a moderate play duration (2–7 hours/day) recorded the highest number of students who tested positive for DQS. Furthermore, the group playing more than 7 hours/day demonstrated that very high play durations were almost certainly associated with the risk of DQS. These findings suggest a significant relationship between play duration and the occurrence of DQS, supporting the hypothesis that longer play durations increase the risk of thumb injuries due to prolonged repetitive activity. This study underscores the importance of controlling gameplay duration to prevent repetitive strain injuries like DQS, particularly among adolescents more vulnerable to technology-based activities.

Mobile Legends is one of the most popular online games, particularly among teenagers. Adolescents often play online games to pass the time or take a break from studying. Playing Mobile Legends can evoke curiosity and even lead to addiction, causing players to want to continue playing. This desire becomes even more vital when players win matches, fueling the urge to play the game continuously.<sup>17</sup> Playing Mobile Legends requires concentration and active finger movements. The continuous bending and holding of the hands and repetitive finger movements can lead to excessive use of the thumbs. This overuse can eventually cause pain in the thumb, as the muscles and tendons are strained from the repetitive motions.<sup>18</sup> Repetitive activities can increase pressure on the tendons around the thumb and wrist, leading to inflammation, pain, swelling, and limited movement. This strain on the tendons can result in conditions such as de Quervain's syndrome, where the tendons become irritated or swollen due to the continuous use of the thumb and wrist.<sup>16</sup>

Previous studies have concluded that the optimal duration for playing mobile games is 2.25 hours daily. Playing mobile games beyond this duration significantly increases the risk of developing de Quervain's syndrome. Extended gaming sessions can lead to overuse of the thumb and wrist, which in turn can cause repetitive strain injuries such as de Quervain's syndrome.<sup>18</sup> It can be concluded that the longer the duration of playing online games, the higher the risk of developing de Quervain's syndrome. Prolonged gaming sessions contribute to repetitive movements of the thumb and wrist, leading to increased strain and the potential for injury.

The positive results of the Finkelstein test increased with the longer duration of gameplay, as the repetitive and rapid movements required in gaming lead to friction and inflammation, accompanied by pain. These repetitive motions, particularly of the thumb and wrist, contribute to the development of de Quervain's syndrome.<sup>15</sup> The repetitive and excessive use of smartphones on the wrist and thumb can increase the load on the joints, potentially leading to acute trauma to the median nerve and thickening of the tendon sheath of the abductor pollicis longus and extensor pollicis brevis. This can contribute to de Quervain's syndrome, characterized by inflammation and pain in the affected areas.<sup>19</sup> Excessive movement and load around the carpometacarpal I joint can cause friction, leading to inflammation in the tendon sheath. This friction then triggers pain in the thumb or along the radial styloid process, which can eventually lead to the development of de Quervain's syndrome.<sup>20</sup>

De Quervain's syndrome can occur due to excessive thumb abduction movements. Repeated stretching of the extensor and abductor tendons is suspected of leading to overuse and friction within the stiff tendon sheath, causing swelling and narrowing in the fibro-osseous canal. The repetitive and static muscle contractions result in spasms, which hinder proper blood circulation. This accumulation of lactate and other chemicals results in the formation of pain impulses that travel through sensory nerve endings to the spinal cord. When these impulses reach the spinal cord, they are interpreted as pain, which is then experienced as the discomfort associated with De Quervain's syndrome. This finding highlights the importance of educating individuals, especially gamers, about smartphone usage duration and incorporating thumb stretching exercises into school health promotion programs.

This study has limitations, such as using a cross-sectional design, which means causal relationships cannot be confirmed. Additionally, the sample only includes students from one school, limiting the generalizability of the results. There may also be self-reporting bias in measuring playing duration, affecting data accuracy. Further validation using monitoring software could improve the reliability of the findings. Future researchers are encouraged to explore additional factors and expand the study's reach to include a broader population of online gaming enthusiasts, offering a more comprehensive understanding of the relationship between the two variables.

These findings can be applied to similar situations where electronic device use is prevalent, such as among e-sports players, office workers who frequently use smartphones, or populations working in technology-based environments. This research provides insight into the risks associated with everyday technology habits. It can serve as a foundation for developing preventive interventions such as education on device ergonomics, hand stretching exercises, and the regulation of gaming or gadget usage in the broader community. Furthermore, this study can help physiotherapists, educators, and policymakers understand the importance of raising awareness about the risk of De Quervain's syndrome among at-risk groups.

Educational programs in schools could involve physiotherapists teaching hand stretching exercises to prevent repetitive strain injuries (RSI) in adolescents. Additionally, limiting gaming duration could be implemented as part of school policies. By involving larger populations in future research, including diverse geographic locations, genders, and professions,

this study could provide more universal recommendations for managing hand and wrist health related to technology-based activities.

## Conclusion

This study shows a significant relationship between the duration of playing Mobile Legends and the occurrence of De Quervain's Syndrome among adolescents. Future research is recommended to explore additional factors, such as the use of other devices and gaming techniques, and to involve a broader sample to enhance the generalizability of the results.

## Author Contribution

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## Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study

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## Ethics Statement

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