



Relationship Between Insomnia Severity and Primary Headache Complaints Among Medical Students of UMM

Risma Karlina Prabawati¹, Atika Salsabila²

¹Department of Neurology, Faculty of Medicine, Universitas Muhammadiyah Malang, Jl. Bendungan Sutami No.188, Sumbersari, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145 Malang, Indonesia

²Faculty of Medicine, Universitas Muhammadiyah Malang, Jl. Bendungan Sutami No.188, Sumbersari, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145 Malang, Indonesia

Correspondence Author : Risma Karlina Prabawati

Email : rismakarlina@gmail.com

Received : October 1st2024. Revised : September 14th2024. Published: December 30th2024

DOI : <https://doi.org/10.22219/sm.Vol20.SMUMM2.39411>

ABSTRACT

Background: Primary headaches and sleep disorders such as insomnia are two health complaints that often occur in society, and influence each other. Medical students are a group that is susceptible to sleep disorders such as insomnia and headaches. This can occur because there are other factors such as stress related to academic pressure, assignments, exams and lack of sleep after activities that cause fatigue and anxiety. Objective: The aim of this study was to determine the relationship between insomnia and primary headache complaints in UMM Medical Faculty students. Methods: This study used an analytical observational method with a cross-sectional approach with the aim of assessing the relationship between insomnia and primary headache complaints in UMM Medical Faculty students. The number of samples in this study was 60 respondents. Data collection used a questionnaire that was asked directly to respondents. Data processing used the SPSS (Statistical Program for Social Science) application. Result: The results of 60 subjects, obtained, respondents with early and moderate insomnia experienced more primary headaches, respectively 25% (15 people) and 15% (9 people). In contrast, respondents without insomnia were more likely to not experience primary headaches, namely 12 people (20%). The results of the Chi-Square test showed a P value of 0.026 <0.05, which means there is a significant relationship between the level of insomnia and primary headaches complaints among UMM FK students. Conclusion: There is a significant relationship between insomnia and primary headache complaints in UMM Medical Faculty students.

Keywords: Cluster Headache, Insomnia, Primary Headache, Tension-type Headache, Migraine,.

Copyright © 2024, Risma Karlina Prabawati et al
This is an open access article under the CC-BY-SA license

INTRODUCTION

Headache and sleep disorders are two common complaints in society, and they are closely related to each other. According to the World Health Organization (WHO) in 2016, approximately 50% of adults aged 18-65 worldwide experience headaches at least once a year. Furthermore, headaches occurring 15 days or more each month affect 1.7-4% of the adult population. Headache

disorders are a global problem affecting individuals of all ages, races, income levels, and geographic regions (World Health Organization, 2016).

Headaches are classified into primary and secondary headaches. Primary headaches include migraines, tension-type headaches (TTH), and cluster headaches. Migraines and TTH are the most common types of primary headache disorders. Migraines affect 14.4% of people worldwide, while TTH affects approximately 26.1% to 86.0% of people globally (Cho et al., 2020). In 2019, there were 581 million cases of migraines and 964 million cases of TTH affecting adolescents and adults aged 15-39 years (Li et al., 2023).

Insomnia is one of the most common sleep disorders and can affect individuals of all ages and races (Ragnoli et al., 2021) (Tiseo et al., 2020). Around 30% of adults suffer from insomnia, and 10% experience severe insomnia (Prasetyo et al., 2018). A study conducted on medical students in Saudi Arabia by Qasim et al. (2021) found that 32.9% of medical students experienced insomnia (Qasim et al., 2021).

Medical students are a group particularly vulnerable to sleep disorders such as insomnia and headaches. This can be due to various factors such as stress related to academic pressures, assignments, exams, and lack of sleep due to their busy schedules, leading to fatigue and anxiety (Azad et al., 2015) (Shrestha et al., 2022) (Sabah et al., 2022).

METHODS

This study employs an analytical observational design with a cross-sectional method. The research was conducted at the Faculty of Medicine, Universitas Muhammadiyah Malang, Class of 2021, from June to August 2024. A total of 60 respondents met the inclusion and exclusion criteria. Data were collected through interviews using the Insomnia Severity Index (ISI) questionnaire to measure insomnia, and the DeSC Healthcare questionnaire to classify the types of primary headaches. The data were then analyzed to achieve the research objective, which was to determine the relationship between insomnia and primary headache complaints among medical students at Universitas Muhammadiyah Malang. The study used both univariate and bivariate data analysis. The univariate analysis was presented in the form of descriptive data to analyze each variable and provide an overview of the characteristics of each variable. The bivariate analysis examined the relationship between insomnia and primary headache complaints using the Chi-square statistical test.

RESULTS AND DISCUSSION

The table 1 explains the age distribution of the FK UMM students who participated as respondents in this study. The majority of the respondents are in the 21-year-old age group, accounting for 68.3% (41 individuals). The 22-year-old group follows with 18.3% (11 individuals),

followed by the 23-year-old group with 6.7% (4 individuals). The 19- and 20-year-old groups each have the same percentage, which is 3.3% (2 individuals). Therefore, most of the respondents are students aged 21. Additionally, out of the total 60 respondents, the majority are female, comprising 68.3% (41 individuals), while males account for 31.7% (19 individuals). This indicates that more females participated as respondents in this study.

Table 1. Distribution of Respondent Characteristics

	Characteristic	N	%
1.	Based on Age		
	19 years	2	3.3%
	20 years	2	3.3%
	21 years	41	68.3%
	22 years	11	18.3%
	23 years	4	6.7%
2.	Based on Gender		
	Male	19	31.7%
	Female	41	68.3%
	Total	60	100%

Table 2. Distribution of Insomnia Severity

Insomnia Severity	N	Percentage
No Insomnia	21	35%
Mild Insomnia	22	36%
Moderate Clinical Insomnia	11	18%
Severe Clinical Insomnia	6	10%
Total	60	100%

Table 3. Distribution of Primary Headache

Primary Headache (PH)	N	Percentage
No Primary Headache	21	35%
Migraine	8	13.3%
Tension-Type Headache (TTH)	30	50%
Cluster Headache	1	1.7%
Total	60	100%

Table 2 explains the distribution of insomnia among the respondents. A total of 36.7% (22 individuals) experience mild insomnia, 18.3% (11 individuals) have moderate clinical insomnia, and

10% (6 individuals) suffer from severe clinical insomnia. Meanwhile, 35% (21 individuals) of the respondents do not experience insomnia. These data show that the majority of the respondents have mild insomnia. Table 3 describes the distribution of primary headaches (PH) among the FK UMM students. Out of the 60 respondents, 50% (30 individuals) have Tension-Type Headache (TTH), 13.3% (8 individuals) experience migraines, 1.7% (1 individual) suffer from cluster headaches, and 35% (21 individuals) do not have any primary headaches. These results indicate that TTH is the most common type of primary headache reported by the respondents.

Table 4 presents the cross-tabulation results between age and primary headache (PH) among FK UMM students. From the table, it can be seen that respondents aged 21 dominate all categories of headache complaints, with 16 individuals not experiencing any primary headaches (26.7%), 6 individuals suffering from migraines (10%), 18 individuals experiencing Tension-Type Headache (TTH) (30%), and 1 individual reporting a cluster headache (1.7%). Table 5 presents the cross-tabulation results between gender and primary headache (PH) among FK UMM students. From the table, it can be observed that female respondents experience all categories of headache complaints more frequently than male respondents, particularly for Tension-Type Headache (TTH), where 20 female respondents (33.3%) report TTH compared to 10 male respondents (16.7%).

Table 4. Distribution of Primary Headache by Age

Age	Primary Headache Type									
	No Headache		Migrain		TTH		Cluster		Total	
	N	%	N	%	N	%	N	%	N	%
19 years	0	0%	0	0%	2	3.3%	0	0%	2	3.3%
20 years	0	0%	0	0%	2	3.3%	0	0%	2	3.3%
21 years	16	26.7%	6	10%	18	30%	1	1.7%	41	68.3%
22 years	4	6.7%	2	3.3%	5	8.3%	0	0%	11	18.3%
23 years	1	1.7%	0	0%	3	5%	0	0%	4	6.7%
Total	21	35%	8	13.3%	30	50%	1	1.7%	60	100%

Table 5. Distribution of Primary Headache by Gender

Gender	Primary Headache Type									
	No Headache		Migrain		TTH		Cluster		Total	
	N	N	N	N	N	N	N	%	N	%
Male	6	10%	3	5%	10	16.7%	0	0%	19	31.7%
Female	15	25%	5	8.3%	20	33.3%	1	1.7%	41	68.3%
Total	21	35%	8	13.3%	30	50%	1	1.7%	60	100%

Table 6. Relationship Between Insomnia Severity and Primary Headache

Insomnia Severity	Primary Headache						Chi Square	P-value
	No		Yes		Total			
	N	%	N	%	N	%		
No Insomnia	12	20.0%	9	15.0%	21	35.0%	9.222	0.026
Mild Insomnia	7	11.7%	15	25.0%	22	36.7%		
Moderate clinical insomnia	2	3.3%	9	15.0%	11	18.3%		
Severe clinical insomnia	0	0.0%	6	10.0%	6	10.0%		
Total	21	35.0%	39	65.0%	60	100.0%		

Table 6 above presents the cross-tabulation results between the level of insomnia and primary headache (PH) among FK UMM students. From the table, it is evident that respondents with mild and moderate insomnia experience more primary headaches, at 25% (15 individuals) and 15% (9 individuals), respectively. In contrast, respondents without insomnia report a higher number of individuals without primary headaches, totaling 12 individuals (20%). The Chi-Square test results show a p-value of $0.026 < 0.05$, which indicates a significant relationship between insomnia and primary headache complaints among FK UMM students.

In this study, the prevalence of insomnia among the subjects was 36% for mild insomnia, 18% for moderate clinical insomnia, 10% for severe clinical insomnia, and 35% did not suffer from insomnia. These findings are consistent with a study by Qasim et al. (2021), which reported that 36.9% of students had mild insomnia, 28.2% had moderate clinical insomnia, 4.7% had severe clinical insomnia, and 30.2% had no insomnia (Qasim et al., 2021). Medical students are particularly vulnerable to insomnia, which may be due to the heavy academic workload and high demands that can lead to stress (Azad et al., 2015). A study by Solanki et al. (2023) found that approximately 70.11% of medical students experienced insomnia, which is closely associated with factors such as heavy workload, mental health issues like depression and anxiety, poor sleep hygiene, consumption of stimulants like coffee and energy drinks, and the use of social media or entertainment platforms (Solanki et al., 2023).

This study also found that 65% of the students at the Faculty of Medicine, Muhammadiyah University of Malang, suffer from primary headaches. This aligns with research by Sharma & Ukey (2023), which showed that 80% of students suffer from primary headaches (Sharma & Ukey, 2023). In this study, the most common type of primary headache was Tension-Type Headache (TTH), affecting 50% of participants, followed by migraines (13.3%) and cluster headaches (1.7%). This is consistent with the findings of Almasned et al. (2018), who reported that 78.57% of medical students

at King Saud bin Abdulaziz University suffered from TTH, 13.57% had migraines, and 0.71% had cluster headaches (Almasned et al., 2018). Another study by Menon & Kinnera (2013) found that about 53% of medical students experience primary headaches, with sleep disturbances and stress being the primary triggers for these headaches (Menon & Kinnera, 2013).

The age range of the subjects in this study was 19-23 years, with the highest incidence of primary headaches occurring in the 21-year-old group (41.7% of respondents). The lowest incidence was in the 19- and 20-year-old groups (3.3% each). These findings differ from a study by Landa et al. (2023), where the highest prevalence of primary headaches occurred at age 20 (15 respondents), followed by age 21 (14 respondents), with the lowest incidence at age 23 (1 respondent) (Landa et al., 2023). In this study, the distribution of primary headaches based on age showed that TTH was the most common type, followed by migraines and cluster headaches, primarily in the 21-year-old group. This distribution aligns with research by Sharma & Ukey (2023), which found that students aged 19-25 often suffer from primary headaches, with TTH being the most common, followed by migraines and cluster headaches. This is likely due to psychosocial factors such as stress, depression, anxiety, and academic pressures (Sharma & Ukey, 2023).

Despite this, the study did not find a significant relationship between age and primary headaches ($p = 0.621$). This is consistent with a study by Sabah et al. (2022), which also found no significant relationship between primary headaches and age, despite the highest incidence occurring in the 20-25 age group (Sabah et al., 2022). This may be due to the homogeneity and narrow age range of the subjects in this study (19-23 years), which limits the ability to detect a significant relationship between age and primary headaches. However, studies with a broader age range, such as that by Al-Hashel et al. (2019), have shown a significant relationship between age and the prevalence of primary headaches, particularly as individuals enter adolescence. This study found a significant increase in the prevalence of primary headaches with age (Al-Hashel et al., 2019). Similarly, research by Wahyuliati & Ardiyanto (2024) demonstrated a significant relationship between age and primary headaches with a p -value of 0.002, using subjects aged 25-60 years (Wahyuliati & Ardiyanto, 2024).

In this study, primary headaches were more common among females (43.3%) compared to males (21.7%). This distribution aligns with findings by Payung et al. (2024), which also showed that primary headaches, particularly TTH and migraines, were more prevalent in females than males (Payung et al., 2024). The higher prevalence of primary headaches in females may be related to psychosocial factors such as stress, heavy workloads, and anxiety (Sharma & Ukey, 2023).

Differences in stress responses between males and females are related to the activity of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, which provide negative feedback during stress. In males, the hypothalamic-pituitary-adrenal axis and autonomic nervous response are generally more active, influencing how they handle stressors (Meilani et al., 2024). Furthermore, females may be more sensitive to pain due to having a lower pain threshold compared

to males (Susanti, 2020). Hormonal differences, especially during menstruation, also contribute to a higher prevalence of primary headaches in females. Estrogen and progesterone regulate chemicals in the brain that influence pain perception, with estrogen playing a key role in modulating pain through serotonin and other pathways (Delaruelle et al., 2018).

Despite these findings, the study did not find a significant relationship between primary headaches and gender ($p = 0.765$). This differs from research by Rafi et al. (2022), which showed a significant relationship between migraines and gender ($p < 0.001$), with females suffering more from migraines than males (Rafi et al., 2022). Similarly, Almasned et al. (2018) found a significant relationship between primary headaches and gender with a p -value of 0.018 (Almasned et al., 2018). The discrepancy in findings may be due to the smaller sample size in this study compared to those of Rafi and Almasned, highlighting the need for a larger sample size to clarify the relationship.

In this study, 50% of subjects with insomnia also experienced primary headaches, and a significant relationship between insomnia and primary headaches was found ($p = 0.026$). This is consistent with a study by Torres-Ferrus et al. (2019), which showed a significant relationship between insomnia and primary headaches ($p < 0.001$) in adolescents aged 12-18 years (Torres-Ferrus et al., 2019). Rovi et al. (2023) also found a significant relationship between insomnia severity and migraines in medical students, with a p -value of 0.002, indicating higher insomnia prevalence in students with migraines compared to those without (Rovi et al., 2023). Medical students often face academic stress and irregular study schedules, which can trigger insomnia and, ultimately, primary headaches. Chen et al. (2018) found that medical students with insomnia, particularly in their final years of study, had a higher prevalence of migraines, underscoring the impact of academic stress and poor sleep on the risk of primary headaches (Chen et al., 2018).

Insomnia can alter various physiological functions that contribute to the onset of headaches. Sleep disturbances like insomnia increase sensitivity to pain, altering central sensitization and worsening the intensity and frequency of primary headaches (Andrijauskis et al., 2020). Insomnia also affects key neurotransmitters such as serotonin and dopamine, which regulate mood and pain signaling. Reduced serotonin levels in individuals with insomnia and migraines lead to increased pain perception (Vgontzas & Pavlović, 2018).

In this study, 15% of subjects with primary headaches did not experience insomnia. This may be due to other factors like stress, anxiety, depression, caffeine consumption, and poor ergonomics, which can also contribute to primary headaches without being directly linked to insomnia. Research by Sharma & Ukey (2023) found that primary headaches in medical students were linked to stress, heavy workloads, and depression, but no relationship was found between insomnia and primary headaches (Sharma & Ukey, 2023). Stress can trigger or exacerbate headaches by increasing muscle tension, releasing catecholamines and cortisol, enhancing peripheral sensitivity, and affecting central pain processing (Repiso-Guardeño et al., 2023).

Lastly, differences in sleep hygiene could also account for the variation in findings. Sayekti et al. (2015) found that good sleep hygiene reduces the risk of insomnia, while poor sleep hygiene increases the likelihood of developing insomnia by 11 times in older adults (Sayekti & Hendrati, 2015). In summary, while this study contributes to our understanding of the relationship between insomnia and primary headaches, these limitations underscore the need for further research with a more comprehensive scope, a larger sample size, and more accurate diagnostic methods to validate and expand upon these findings.

CONCLUSION

In conclusion, this study highlights the high prevalence of both insomnia and primary headaches among medical students at Muhammadiyah University of Malang, and underscores the significant link between insomnia and the occurrence of primary headaches. However, no significant associations were found between age, gender, and primary headaches. Based on the findings and limitations of this study, several recommendations for future research can be made. First, expanding the study to include different populations and locations would allow for more generalizable results. The current study was limited to a specific group of students from a single university, so broadening the sample to include participants from various universities or even different demographic groups could provide a more comprehensive understanding of the relationship between insomnia and primary headaches. Second, future researchers could enhance the scope of their studies by incorporating additional variables or comparison groups. While this study focused on insomnia and its relationship with primary headaches, other factors such as stress, anxiety, depression, and sleep hygiene also play significant roles in both conditions. Including these variables, or comparing groups such as those with and without mental health disorders, could offer deeper insights into the multifaceted nature of these health issues. Lastly, to improve the accuracy of insomnia measurement, future studies should consider using more objective diagnostic methods. While this study relied on self-reported questionnaires, methods like polysomnography or actigraphy could provide more precise data on sleep patterns and disorders. Polysomnography is the gold standard for diagnosing sleep disorders, while actigraphy offers a less invasive alternative that tracks sleep cycles over extended periods. Using these tools would increase the reliability of the results and offer a clearer picture of the relationship between insomnia and primary headaches. Incorporating these recommendations could strengthen the validity and generalizability of future studies, helping to better understand the complex interactions between insomnia, headaches, and other contributing factors.

REFERENCES

- Al-Hashel, J. Y., Ahmed, S. F., & Alroughani, R. (2019). Prevalence and burden of primary headache disorders in Kuwaiti children and adolescents: A community based study. *Frontiers in Neurology*, 10(JUL), 1–7. <https://doi.org/10.3389/fneur.2019.00793>
- Almesned, I. S., Alqahtani, N. G., Alarifi, J. A., Alsaawy, T. N., Agha, S., & Alhumaid, M. A. (2018). Prevalence of primary headache among medical students at King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia. *Journal of Family Medicine and Primary Care*, 6(2), 1193–1196. <https://doi.org/10.4103/jfmpe.jfmpe>
- Andrijauskis, D., Ciauskaite, J., Vaitkus, A., & Pajediene, E. (2020). Primary Headaches and Sleep Disturbances: A Cause or a Consequence? *Journal of Oral & Facial Pain and Headache*, 34(1), 61–66. <https://doi.org/10.11607/ofph.2405>
- Azad, M. C., Fraser, K., Rumana, N., Abdullah, A. F., Shahana, N., Hanly, P. J., & Turin, T. C. (2015). Sleep disturbances among medical students: A global perspective. *Journal of Clinical Sleep Medicine*, 11(1), 69–74. <https://doi.org/10.5664/jcsm.4370>
- Chen, C. Y., Yu, N. W., Huang, T. H., Wang, W. S., & Fang, J. T. (2018). Harm avoidance and depression, anxiety, insomnia, and migraine in fifth-year medical students in Taiwan. *Neuropsychiatric Disease and Treatment*, 14, 1273–1280. <https://doi.org/10.2147/NDT.S163021>
- Delaruelle, Z., Ivanova, T. A., Khan, S., Negro, A., Ornello, R., Raffaelli, B., Terrin, A., Mitsikostas, D. D., & Reuter, U. (2018). Male and female sex hormones in primary headaches. *Journal of Headache and Pain*, 19(1), 1–12. <https://doi.org/10.1186/s10194-018-0922-7>
- Landa, D. A., Sp.OT, D. S. D. T. R. M. B., & FISCAM, D. S. M. J. K. . M. ,MMP. F. . (2023). Peningkatan Angka Kejadian Nyeri Kepala Primer Terhadap Kualitas Tidur Buruk Pada Mahasiswa Fakultas Kedokteran Universitas Nusa Cendana Tahun 2020. *Cendana Medical Journal*, 11(2), 259–271. <https://doi.org/10.35508/cmj.v11i2.13918>
- Meilani, Aras, D., & Hasyar, A. R. A. (2024). Hubungan Antara Tingkat Stres Dengan Kejadian Nyeri Kepala Primer Pada Mahasiswa S1 Fisioterapi Fakultas Keperawatan Universitas Hasanuddin. *Indonesian Journal of Physiotherapy*, 4(1), 1–13.
- Menon, B., & Kinnera, N. (2013). Prevalence and characteristics of migraine in medical students and its impact on their daily activities. *Annals of Indian Academy of Neurology*, 16(2), 221–225. <https://doi.org/10.4103/0972-2327.112472>
- Payung, D. J., Huwae, L. B. S., Ruspanah, I., Silalahi, Y. P., de Lima, F. V. I., & Nikijuluw, E. (2024). Prevalensi Jenis Nyeri Kepala Primer (Migraine, Tension Type Headache, Cluster Headache) Pada Mahasiswa Fakultas Kedokteran Universitas Pattimura . *Journal Molucca Medica*, 17(1), 1–7.
- Qasim, S., Alrasheed, A., Almesned, F., Alduhaymi, M., Aljehaiman, T., & Omair, A. (2021). Insomnia among medical students and its association with exams. *International Journal of*

- Medicine in Developing Countries, February, 682–687. <https://doi.org/10.24911/ijmdc.51-1609614810>
- Rafi, A., Islam, S., Hasan, M. T., & Hossain, G. (2022). Prevalence and impact of migraine among university students in Bangladesh: findings from a cross-sectional survey. *BMC Neurology*, 22(1), 1–11. <https://doi.org/10.1186/s12883-022-02594-5>
- Repiso-Guardeño, Á., Moreno-Morales, N., Labajos-Manzanares, M. T., Rodríguez-Martínez, M. C., & Armenta-Peinado, J. A. (2023). Does Tension Headache Have a Central or Peripheral Origin? Current State of Affairs. *Current Pain and Headache Reports*, 27(11), 801–810. <https://doi.org/10.1007/s11916-023-01179-2>
- Rovie, F., Widayanti, & Bhatara, T. (2023). Hubungan Derajat Insomnia dan Kejadian Migrain pada Mahasiswa Tingkat 3 Fakultas Kedokteran Universitas Islam Bandung. *Bandung Conference Series: Medical Science*, 3(1), 600–606. <https://doi.org/10.29313/bcsms.v3i1.6377>
- Sabah, Z. U., Aziz, S., Narapureddy, B. R., Alasiri, H. A. A., Asiri, H. Y. M., Asiri, A. H. H., Alsulami, A. A. H., Hassan, N. K. A., Mohammed Asif, S., & Alsyd, S. M. (2022). Clinical-Epidemiology of Tension-Type Headache among the Medical and Dental Undergraduates of King Khalid University, Abha, Saudi Arabia. *Journal of Personalized Medicine*, 12(12). <https://doi.org/10.3390/jpm12122064>
- Sayekti, N. P. I. W., & Hendrati, L. Y. (2015). Analisis Risiko Depresi, Tingkat Sleep Hygiene Dan Penyakit Kronis Dengan Kejadian Insomnia Pada Lansia Risk Analysis of Depression, Sleep Hygiene Level and Chronic Disease with Insomnia in Elderly. *Jurnal Berkala Epidemiologi*, 3(2), 181–193.
- Sharma, S. K., & Ukey, U. U. (2023). Epidemiology of Primary Headache and Its Associated Psychosocial Factors Amongst Undergraduate Medical Students: A Cross-Sectional Study From the Vidarbha Region. *Cureus*, 15(5). <https://doi.org/10.7759/cureus.39456>
- Solanki, S., Venkiteswaran, A., & Saravanabawan, P. (2023). Prevalence of Insomnia and Factors Influencing Its Incidence in Students of Tbilisi State Medical University: A Cross-Sectional Study. *Cureus*, 15(9). <https://doi.org/10.7759/cureus.46084>
- Susanti, R. (2020). Potential Gender Differences in Pathophysiology. *Jurnal Human Care*, 5(2), 539–544.
- Torres-Ferrus, M., Vila-Sala, C., Quintana, M., Ajanovic, S., Gallardo, V. J., Gomez, J. B., Alvarez-Sabin, J., Macaya, A., & Pozo-Rosich, P. (2019). Headache, comorbidities and lifestyle in an adolescent population (The TEENS Study). *Cephalalgia*, 39(1), 91–99. <https://doi.org/10.1177/0333102418777509>
- Vgontzas, A., & Pavlović, J. M. (2018). Sleep Disorders and Migraine: Review of Literature and Potential Pathophysiology Mechanisms. *Headache*, 58(7), 1030–1039. <https://doi.org/10.1111/head.13358>
- Wahyuliati, T., & Ardiyanto, R. (2024). Profil Faktor Risiko Yang Berhubungan Pada Nyeri Kepala Primer. *10(3)*, 343–352