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Smartphone Usage and Risk of Tension-type Headache Incidence in Sorong, Southwest Papua: A Hospital-Based Study

Yusuf Hermawan[1], Andrew Ivan Humonobe[2*], Antonius Robertus Irawan Santosa[3]
[1,2] Faculty of Medicine, Universitas Papua, Sorong, Southwest Papua
[3] RSUD Sele Be Solu, Sorong, Southwest Papua
Corresponding Author: Andrew Ivan Humonobe a.humonobe@unipa.ac.id

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A B S T R A C T

This research was aimed to analyze the relationship between smartphone usage and tension-type headache incidence in patients at Sorong hospital. This was a quantitative observational study with cross-sectional design. A total of 135 headache patients were included. All participants were interviewed and analyzed using headache screening questionnaire (HSQ) with scoring equal to 8 was considered as TTH. Statistical analysis were done using chi-square tests. Study showed that 79 subjects (58.5%) had tension-type headache. Significant relationship were observed regarding duration (p=0.04), frequency (p=0.02), and subject's head position (p=0.03) of smartphone usage with the incidence of tension-type headache. Smartphone usage played a role in tension-type headache incidence among patients in Sorong hospital.

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INTRODUCTION

Headaches represent the most frequent complaint communicated to healthcare providers. Even though 90% of headaches are not harmful, it is crucial for practitioners to ascertain the difference between potentially dangerous severe forms of headaches and non-life-threatening benign headaches. Headaches can usually be categorized as primary or secondary. Primary headaches include tension-type headache (TTH), migraine, and cluster headaches for which the underlying cause is unknown. In contrast, secondary headaches are attributed to other conditions such as head injuries, intracranial infections, strokes and other cerebrovascular episodes, seizures, and brain tumors.[1,2] In 2016, the World Health Organization estimated that globally, about 50% of the adult population suffer from headache disorders, and 50 to 75% of adults between the ages of 18 and 65 years, experience headaches.[3] Tension-type headache (TTH) is the most frequent primary headache type in the general population. TTH are generally perceived as mild and society considers TTH as mild because of the association with lower-intensity symptoms. This symptom association is, however, not the reality for several headache disorder sufferer. They suffer severe pain and disability, which impacts their ability to be productive at work, school, or home. This makes pain from TTH particularly disruptive. TTH is characterized by bilateral pain that is pressing, tightening, non-pulsating, mild to moderate in intensity, not influenced by physical activity, not accompanied by nausea or vomiting, and may include photophobia or phonophobia.

Nowadays, the development of information and communication is crucial in this era of globalization. The number of smartphone users in Indonesia is currently growing rapidly, indicating that Indonesia ranks fourth in the world for the largest number of smartphone users, with 160.23 million users. Smartphone users in the country have reached 58.6% of the total population. According to the Indonesian Central Statistics Agency, the percentage of active smartphone users in West Papua is 91.86%, with the age range above 15-34 years. The benefits of smartphone usage in society are widely recognized, as they facilitate access to information related to social media, work, and learning, thereby assisting individuals in their daily lives. However, smartphone usage does not only have positive impacts; excessive and prolonged use can lead to negative effects such as reduced interaction with family, anxiety disorders, dry eyes, red eyes, blurred vision, and even headaches. One of the factors that may possibly causing tension-type headaches is the use of smartphones. It was found that the majority of adults use smartphones daily because smartphones facilitate daily activities and work to meet their living needs. This study aims to analyze the relationship between smartphone usage and tension-type headache incidence in patients at Sorong Hospital.

THEORETICAL REVIEW

Tension-type headaches (TTH) are defined by repeated headache episodes that may persist from minutes to weeks. The discomfort is typically described as pressing or constricting, with mild to moderate intensity, bilateral, and does not worsen with regular physical exercise. Nausea and vomiting are generally absent; nevertheless, photophobia or phonophobia may manifest. The Global

Burden of Disease study (GBD 2016) indicates that TTH is potentially the third most common illness, affecting almost 1.89 billion people. The global age-standardized prevalence was 26.1%, with rates of 30.8% for women and 21.4% for males. The impact of disability and the years lived with disability (YLD) were most pronounced in the 35 to 39 age group. According to the International Classification of Headache Disorders 3rd edition (ICHD-3), there are three primary subtypes of tension-type headache (TTH) categorized by the frequency of headache episodes: infrequent episodic TTH (episodes occurring less than once a month), frequent episodic TTH (episodes occurring 1–14 days per month), and chronic TTH (headaches occurring on 15 or more days per month). The pathophysiology of TTH is likely complex and differs among its subtypes. It has been proposed that peripheral and environmental factors are more prominent in episodic TTH, while genetic and central factors may have a substantial influence in the chronic form.

Hereditary variables appear to have a little influence on the pathophysiology of episodic tension-type headache, in stark contrast to migraine. Nonetheless, genetic factors significantly influence the pathophysiology of chronic TTH. Peripheral sensitization of myofascial nociceptors is a significant factor in the onset of episodic TTH. There are two main types of myofascial factors: pericranial pain and myofascial trigger points. Peripheral nociceptors are most likely what cause pericranial pain. It has been proposed that nociceptors located around blood vessels in striated muscle, tendon insertions, and fascia are the origin of pain. The potential peripheral mechanisms encompass inflammatory responses, reduced blood circulation, heightened muscular activity, and muscle atrophy. A myofascial trigger point (TrP) is a very sensitive area on a skeletal muscle that hurts when it is compressed or stretched. Active TrPs result in clinical symptoms, however latent TrPs may lead to alternative muscular dysfunctions such as tiredness and limited range of motion instead of pain. A non-blinded investigation revealed that individuals with TTH had a higher prevalence of either active or latent TrPs compared to healthy individuals. In an additional blinded investigation, chronic TTH was correlated with activated trigger points in multiple head and neck muscles. Individuals with chronic TTH exhibiting active TrPs experienced heightened headache intensity, duration, and frequency compared to those with latent TrPs. Another factor is the central factor. In patients with chronic TTH, persistent myofascial nociception may lead to central alterations (central sensitization), likely occurring at both the supraspinal level and inside the spinal dorsal horn/trigeminal nucleus. The probable alterations encompass heightened central excitability and diminished central pain inhibition. This may cause much more pain around the head. So, in a state of chronic pain, increased tenderness is caused by both peripheral nociception and central sensitization.

The mechanism underlying the association between smartphone use and TTH is not well understood; however, some propose that the breakdown of the blood-brain barrier due to exposure to low-intensity microwave frequency energy may play a role. The dopamine-opiate system may play a role in headaches, and exposure to low-intensity electromagnetic energy impacts these

systems. The evidence indicates a complex and inconsistent relationship between smartphone use and tension-type headache (TTH), with no definitive causal link established. Numerous studies present inconsistent findings. Rabbani et al. (2021) reported no significant correlation between smartphone usage duration or position and tension-type headache (TTH) prevalence among medical students (p=0.285 and p=0.114). In a similar study, Santosa et al. (2019) found no significant association between smartphone use and TTH (p=0.127). However, Wang et al. (2017) performed a meta-analysis indicating that mobile phone use is associated with a 38% increase in headache risk (OR 1.38, 95% CI 1.18-1.61). Kartika et al. (2023) identified a moderate correlation between smartphone addiction and the risk of tension-type headache, with a correlation coefficient of 0.454. Other studies also indicated similar findings. Nevertheless, the evidence is inconclusive, indicating a necessity for more extensive longitudinal studies to clearly define the relationship.

METHODOLOGY

This research is a quantitative observational study using an analytical approach with a cross-sectional study design. The subjects in this study are headache patients in Sorong Hospital, Southwest Papua. The selected subjects are those who meet the inclusion criteria, such as owning a smartphone and filling out the informed consent form. We exclude patients with a history of secondary headaches (ie: head injuries), headaches accompanied by aura, and those predominantly using other electronic devices. Using the Slovin formula, it was found that the subjects in this study totaled 135 people, consisting of 42 males and 93 females. The average subject is aged between 15 years and over than 65 years.

The instrument used in this research is a questionnaire. The questionnaire in this study consists of smartphone usage questionnaire from Busch and Headache Screening Questionnaire (HSQ) for the tension-type headache screening.[9,10] The interpretation of the HSQ score is as follows: total score = 8 indicating a condition of tension-type headache; and total score < 8 indicates no experience of tension-type headache.

The variables assessed were the duration of smartphone use, frequency of smartphone use and head position when using a smartphone with the incidence of tension type headache. The data obtained were then analyzed using the Chi-square test. A p value of <0.05 indicates a significant result.

RESULTS

From all the research subjects, it was found that 79 individuals (58.5%) experienced tension-type headaches, while 56 individuals (41.5%) did not have tension-type headaches. Based on the results of this study, it was found that among those who used smartphones for less than 2 minutes, there were 7 respondents (5.2%) who experienced tension-type headaches. For those who used smartphones for 2-60 minutes, there were 14 respondents (10.4%) with tension-type headaches, while for those who used smartphones for more than 60 minutes, there were 58 respondents (43.0%) who experienced tension-type headaches. From the statistical test, a p-value of 0.004 (<0.05) was obtained,

which indicates that there is a relationship between the duration of smartphone use and the occurrence of tension-type headaches in patients at Sorong Hospital.

Table 1. The Relationship Between Smartphone Usage Duration and Tension-Type Headache Incidence

Duration of Smartphone Use	Tension type headache				p-value
	Yes		No		
	n	%	n	%	
<2 Minutes	7	5.2%	17	12.6%	
2-60 Minutes	14	10.4%	10	7.4%	0.004*
>60 Minutes	58	43.0%	29	21.5%	
Total	79	58.5%	56	41.5%	135

*Chi-square test p <0.05

This study shows that among smartphone users with a frequency of less than 2 times a day, there were 2 respondents (1.5%) who experienced tension-type headaches. For those using smartphones 2-10 times a day, there were 27 respondents (20.0%) with tension-type headaches, while for users exceeding 10 times a day, there were 50 respondents (37.0%) who experienced tension-type headaches. The statistical test yielded a p-value of 0.002 (<0.05), indicating that there is a relationship between the frequency of smartphone use and the occurrence of tension-type headaches among patients at Sorong Hospital.

Table 2. The Relationship Between Smartphone Usage Frequency and Tension-Type Headache Incidence

Smartphone Usage Frequency	Tension-type headache				p-value
	Yes		No		
	n	%	n	%	
<2 times a day	2	1.5%	12	8.9 %	
2-10 times a day	27	20.0%	18	13.3%	0.002*
>10 times a day	50	37.0%	26	19.3%	
Total	79	58.5%	56	41.5%	135

Chi-square test p <0.05

The research results indicate that among the use of smartphones with the neck in an upright position, 14 respondents (10.4%) experienced tension-type headaches. In contrast, with the smartphone usage position of looking down/up, 59 respondents (43.7%) experienced tension-type headaches. For other smartphone usage positions (lying down), 6 respondents (4.4%) experienced tension-type headaches. From the statistical test, a p-value of 0.003 (<0.05) was obtained, which means there is a significant relationship between the head position while using smartphones and the occurrence of tension-type headaches in patients at Sorong Hospital.

Table 3. Relationship Between Head Position While Using Smartphones and the incidences of Tension-Type Headaches

Head Position While Using Smartphones	Tension-type headache				p-value
	Yes		No		
	n	%	n	%	
Straight posture	14	10.4%	23	17.0%	
Head down/up right	59	43.7%	26	19.3%	0.003*
Others (lying down)	6	4.4%	7	5.2%	
Total	79	58.5%	56	41.5%	135

Chi-square test p <0.05

DISCUSSION

The results of this study indicate that there is a significant relationship between the duration of smart phone use and the incidence of tension-type headaches in patients at Sorong Hospital. The highest duration of smart phone use is >60 minutes as many as 58 respondents (43.0%) who experience tension-type headaches, meaning that playing smart phones for a long duration can increase the risk of getting tension-type headaches. This study is in line with research conducted by Santosa et al (2019) that there is a significant relationship between the use of smartphones and the incidence of tension-type headaches.

In theory, the use of smart phones with a long duration of time can cause tension in several muscles, thus causing the incidence of tension-type headaches.The use of smart phones more than 1 hour could affect eye health due to light injection, photosensitive and dry eyes occur due to lack of tear production, also blurred vision caused by tensed ocular muscles leading to tension-type headache This study also showed that there was a significant relationship between the frequency of smartphone use and the incidence of tension-type headaches. The highest use of smartphone is more than 10 times a day as many as 50 respondents (37.0%) who experience tension-type headaches, meaning that frequent use of smartphones had more chances of getting tension-type headaches. This study is in line with research conducted by Ishii et al (2024) that there is a significant relationship between the frequency of use of smart phones and tension-type headaches. Another research conducted by Oroh et al (2016) the frequency of use of smart phones complaining of tension-type headaches is as much as (75.71%) compared to other primary headaches, head pain can be related to the frequency of use of smart phones increases the prevalence ratio significantly increases for neck pain or shoulder pain, and eye muscle fatigue, high frequency of use of cell phones can be related to the incidence of tension-type headaches, high frequency of use of smart phones due to the many various features provided by smart phones and a lot of interesting information that can be accessed anytime and anywhere so that it makes its users spend a lot of time interacting with smart phone screens. Using smart phones with high frequency can cause various negative impacts for its users such as addictive which has an impact on less physical activity, disrupting sleep and a high risk of developing tension-type headaches.

From the results of this study that there is a significant relationship between the head position of smart phone use and the incidence of tension-type headaches in patients at Sorong Hospital. The results showed that most people use smartphones with a head bowed / upturned position, namely 59 respondents (43.7%), experiencing tension-type headaches, meaning that using smartphones with this pose leads to higher chance of experiencing tension-type headaches. This study is in line with research conducted by Oroh et al (2016) in which most of the subjects used smart phones with a tilt-head position (48.56%). Improper head position, especially flexed neck and static body posture, is associated with neck pain and head pain where the neck muscles play an important role. In theory, head position that stays in a long duration and continuous static posture like bowing can cause complaints of headache, which caused by prolonged contraction of the cranial muscles leading to vasoconstriction of blood vessels, thus blood flow is reduced. The result of decreased blood flow will cause inhibition of oxygen distribution and accumulation of metabolic products which ultimately cause pain. Impulses in pain in the head will be channeled to the cerebral cortex by the nervus trigeminus and cervical nerves I, II, and III, giving rise to tension-type headaches.

CONCLUSIONS AND RECOMMENDATIONS

The results of our research indicate notable correlations between the duration, frequency, and head position during smartphone usage and the incidence of TTH. This study underscores the necessity of regulating smartphone usage regarding both duration and frequency, alongside the maintenance of appropriate posture to mitigate tension-type headaches. The findings indicate that awareness campaigns aimed at promoting ergonomic smartphone usage and encouraging breaks may effectively decrease the occurrence of tension-type headaches, particularly among high-risk populations, including young adults and frequent smartphone users.

FURTHER STUDY

This study offers important insights into the association between smartphone use and TTH; however, it has several limitations: 1. Cross-Sectional Design; 2. Limited Sample Size and Generalizability; 3. Lack of Control for Confounding Variables; 4. The study exclusively examines the short-term effects of smartphone use. Future research should consider the following recommendations to address these gaps: 1. Longitudinal Studies: Future research should implement a longitudinal design to investigate the causal relationship between smartphone use and TTH; 2. A larger and more diverse sample, encompassing various geographic locations, age groups, and socioeconomic backgrounds, is necessary to improve the generalizability of the findings. Incorporating individuals from diverse cultural and occupational backgrounds will enhance the understanding of the effects of smartphone use on TTH; 3. Control for Confounding Factors: Future research must consider additional variables that may affect TTH, including stress levels, sleep quality, physical activity, and other health conditions. 4. Investigate Long-Term Effects: Longitudinal studies are essential to assess the chronic impacts of extended

smartphone use on the prevalence and severity of TTH. These studies may investigate the potential correlation between sustained smartphone use and a progressive increase in TTH symptoms over time.

Addressing these limitations and recommendations will enable future studies to yield more comprehensive insights into the mechanisms connecting smartphone use and TTH, thereby informing preventive strategies and clinical practices.

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