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ORIGINAL ARTICLE

Comorbidities, social, and psychological factors associated with headache in adult Indonesians: data from the 5th Indonesian Family Life Survey (IFLS-5)

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ABSTRACT

BACKGROUND
Headache is a significant health problem worldwide, but national data on headaches in Indonesia are unavailable. Various risk factors have been identified as triggers or factors affecting its occurrence and severity. This study aimed to identify factors associated with headache occurrence in Indonesians aged 20 to 65 years.

METHODS
A cross-sectional study was conducted involving 26,263 participants aged 20 to 65 years. We covered any social, psychological, and comorbidity variables found in the fifth Indonesian Family Life Survey (IFLS) that could be linked to headaches. A multivariate-adjusted logistic regression model was used to estimate the odds ratios (ORs) and 95% confidence intervals (CI).

RESULTS
The prevalence of those who had headache once in the past four weeks was 62.1%. Headache was associated with sleep disturbances (OR 2.24; CI 95% 2.11 – 2.36; p<0.001), depression (OR 1.79; CI 95% 1.67-1.92; p<0.001), hypertension (OR 1.79; CI 95% 1.64 – 1.96; p<0.001), female sex (OR 1.64; CI 95% 1.55 – 1.73; p<0.001), early adulthood (OR 1.32; CI 95% 1.24 – 1.42; p<0.001), hypercholesterolemia (OR 1.33; CI 95% 1.15 – 1.52; p = 0.001), poor/moderate sleep quality (OR 1.22; CI 95% 1.15 – 1.29; p<0.001), and low income (OR 1.12; CI 95% 1.05 – 1.19; p = 0.001).

CONCLUSIONS
This study demonstrated that sleep disturbances were the dominant risk factor of headache in subjects aged 20 to 65 years. Furthermore, sleep disturbance treatment should especially be considered in patients with a high level of headache.

Keywords: Comorbidity, epidemiologic factors, global burden of disease, headache, adults

INTRODUCTION

Headache is a significant health problem affecting all populations worldwide. According to the International Classification of Headache Disorders (ICHD-3), headache is pain in the head above the orbitomental line and/or nuchal ridge.[1] It can vary significantly in terms of the location (in the face, head, around the eye, neck, or even generalized), and intensity (pressure/band-like, throbbing, constant, sharp, or dull pain). Headache can also arise from pain-sensitive structures in the head including extracranial structures (skin, muscles, blood vessels in the head and neck, mucosa of the sinuses, and dental structures) and intracranial structures (including the regions of the large arteries near the circle of Willis, the great venous sinuses, parts of the dura and dural arteries, and cranial nerves).[2]

National data on headaches in Indonesia are still unavailable up to this date.[3] Indonesia's most recent Baseline Health Research / Riskesdas was conducted in 2018 under the supervision of the National Institute of Health Research and Development of the Indonesian Ministry of Health. These national data did not include specific data for headache disorders in their data registry. According to the Global Burden of Disease (GBD) study, headache disorders in Indonesia ranked second as a cause of most years lived with disability/YLD (6.87% of total YLDs; ranging from 1.18% to 14.19%) among the population, being directly below back pain (9.39% of total YLDs; ranging from 7.75% to 11.13%).[4]

Studies analyzing the association between headache and several demographic factors in Indonesia are limited. A recent study by Barus et al.[5] on factors associated with headache symptoms among Indonesian adolescents reported that headache had the strongest association with sleep disturbances. Information about headache disorders in adults is scarce; most of the available studies have been carried out in younger patients. There were no equivalent studies in the adult population, and the evidence was still contentious, even though this knowledge was critical.

Based on several proposed mechanisms of headache disorders, various risk factors have been identified as triggers or factors affecting its occurrence and severity. These factors are advanced age, demographic (e.g., sex and race), a history of head trauma, lower socioeconomic status, psychological stress, poor sleep quality due to sleep disorders, caffeine or medication overuse, and comorbidities (obesity, pro-inflammatory diseases, and chronic diseases).[6] The present study aimed to determine the association between several factors available in the fifth Indonesian Family Life Survey (IFLS-5) and headache occurrence to identify the most dominant factor.

METHODS

Research design

This cross-sectional study used secondary data from the latest Indonesian Family Life Survey (IFLS) longitudinal study, namely the fifth IFLS, conducted from September 2014 to April 2015.[7] We covered any social, psychological, and comorbidity variables found in the fifth IFLS that could be linked to headaches.

Research subjects

The data presented in this study were obtained from the Indonesian Family Life Survey (IFLS) longitudinal survey designed as a cross-sectional study conducted using in-person interviews with adult participants. This survey was based on a sample of households from 13 of the nation's 26 provinces in 1993. We decided to use these data since they contain complete and relevant information about socioeconomics and health, mainly about headache, in a representative sample of 83% of the Indonesian population.[7]

The inclusion criteria for the present study were adults who (i) were aged 20 to 64 years, (ii) filled the "acute symptoms" section of the interview questionnaire either with yes or no in headache symptom. The exclusion criteria were (i) subject not fulfilling age criteria, (ii) adult with incomplete records or information (age, sex, education status, socioeconomic status, comorbidities, and psychological status).

Questionnaire

Headache was the outcome variable of this study. Since the survey was a continuation of the previous poll, the fifth-wave interviewers used the same questions from earlier waves with some adjustments. The participants were asked about acute symptoms (including headache, fever, flu-like symptoms, cough, shortness of breath, fever, abdominal pain, nausea, vomiting, diarrhea, swollen feet, pain in the eyes, toothache, and oral ulcers) in the past four weeks, along with several symptoms related to comorbidities such as heart disease, diabetes, and high blood pressure in "yes"

or "no" questions. The severity, onset, duration, and characteristics of the symptoms were not specified.[7]

Age, sex, education level, overall economic status, mental disorder (depression), and comorbidities (hypertension, hypercholesterolemia, heart disorder, stroke, and sleeping disturbance) were the headache factors being explored in our study. These factors were chosen because they were available in the IFLS survey form and had long been known to contribute to the development of headaches. Age was divided into two groups: 20 to 45 years and 45 to 65 years. This classification is in line with the definition of adulthood (≥20 years to 64 years) according to the World Health Organization (WHO).[7]

Education level was assessed by several questions such as (1) "Have you ever attended school?", and (2) "What is the highest education level you attained?", answered with primary school, junior high school or equivalent, senior high school or equivalent, and college or university (D1, D2, D3). Education level was then classified into two groups: ≤9 years (primary school or less) and ≥9 years (secondary school, or graduate and above, such as college or university).[7]

Economic status was measured subjectively using a self-report approach. It was then categorized into "low income" and "middle/high income". Comorbidities such as hypertension, hypercholesterolemia, diabetes, heart failure, and stroke were determined by asking whether or not the respondent had been diagnosed by a doctor previously with these conditions. Because in low and middle-income countries many people with headache do not go to see a doctor, in this case, the diagnoses made by other practitioners (nurse, paramedic, trained midwife) were also counted. We did not do further confirmatory tests.[7]

Depression

Depression was determined using a short version of the Center of Epidemiologic Studies Depression Scale (10-item CES-D scale). The CES-D scale is a powerful screening tool for identifying depressive symptoms in the general population. The full version of the 20-item scale is a self-report measure of depressive symptoms in the past week. It is designed for studies ascertaining the relationship between depression and other variables. The 10-item CES-D, the short version of CES-D, has shown comparable accuracy to the original CES-D in several studies classifying subjects with depressive symptoms.[8] The sensitivity of the 10-item CES-D 10 was 91%, with a specificity of 92% and a positive predictive value of 92%.[9]

Sleep

The sleep section consists of ten questions, five on sleep quality and five on sleep deprivation and its consequences. The questions were retrospective over the last seven days. Questions were answered on a five-point ordinal scale indicating agreement or not with the statements. These questions were translated and re-translated, referring to Patient-Reported Outcomes Measurement Information System (PROMIS) guidelines.[7] Staff of Survey, Measurement, Training, and Research (SurveyMETER), an independent research organization, did the initial translation into Indonesian. We grouped sleep disturbance items into two groups for analysis: often/sometimes (always, often, and sometimes) and never (never and rarely). Similarly, sleep quality has two groups: poor/moderate (very bad, bad, moderate) and good (good and very good).[7]

Statistical analysis

All statistical analyses were done using SPSS Statistics version 26. The present study used two main analyses, the bivariate and multivariate analyses. We used chi-squared test in the bivariate analysis as all variables were categorical. In the multivariate analysis, we used logistic regression. A multivariate-adjusted logistic regression model with "Enter" method was used to estimate the odds ratios (ORs) and 95% confidence intervals (CI) of the factors associated with headaches.

Ethical clearance

The IFLS data used in the present study have been reviewed and approved by institutional review boards at the RAND Corporation in the United States and the University of Gadjah Mada in Indonesia. The data were also made publicly available. Written consent had been obtained from all participants before data collection began. The protocol approval or ethical clearance number from RAND's Human Subjects Protection Committee (RAND's IRB) was s0064-06-01-CR01.[7]

Table 1. Demographic characteristics and factors affecting headache development (n=26,263)

Variables	Headache		Unadjusted OR (95 % CI)	p value
	Yes (16,311) n (%)	No (9,952) n (%)		
Age (years)				
20 to 44	11,934(64.2)	6,665(35.8)	1.34	<0.001
45 to 65	4,377(57.1)	3,287(42.9)	(1.27-1.42)	
Sex				
Female	9,483(67.5)	4,558(32.5)	1.64	<0.001
Male	6,995(55.8)	5,541(44.2)	(1.56-1.72)	
Education (n=26,186)				
≥9 years	7,678(63.6)	4,385(36.4)	1.12	<0.001
<9 years	8,587(60.8)	5,536(39.2)	(1.07-1.18)	
Economic status (n = 26,158)				
Low-income	4,169(63.5)	2,392(36.5)	1.08	0.007
Middle-income	12,086(61.7)	7,511(38.3)	(1.02-1.14)	
Depression				
Yes	4,593(76.9)	1,373(23.1)	2.44	<0.001
No	11,718(57.7)	8,579(42.3)	(2.29-2.61)	
Hypertension				
Yes	2,351(74.0)	828(26.0)	1.86	<0.001
No	13,960(60.5)	9,124(39.5)	(1.70-2.01)	
Hypercholesterolemia				
Yes	842(71.1)	343(28.9)	1.52	<0.001
No	15,469(61.7)	9,609(38.3)	(1.34-1.73)	
Diabetes mellitus				
Yes	393(65.2)	211(34.8)	1.14	0.140
No	15,918(62.0)	9,741(38.0)	(0.96-1.35)	
Heart disorders				
Yes	279(67.4)	135(32.6)	1.26	0.029
No	16,032(62.0)	9,817(38.0)	(1.02-1.55)	
Stroke				
Yes	91(63.2)	53(36.8)	1.04	0.854
No	16,220(62.1)	9,899(37.9)	(0.74-1.47)	
Sleep disturbance				
Often/Sometimes	9,099(74.3)	3,147(25.7)	2.72	<0.001
Never	7,212(51.4)	6,805(48.6)	(2.58-2.87)	
Sleep quality				
Poor/Moderate	11,430 (65.6)	6,001(34.4)	1.54	<0.001
Good	4,881(55.3)	3,951(44.7)	(1.46-1.62)	

Note :Data presented as n(%);OR=Odds ratio; CI=Confidence interval

RESULTS

Table 1 shows the characteristics of the participants aged above 20 years that we included in this study. The eligible population for this study comprised 26,263 aged 20 to 65 years, after we had excluded 7,978 participants who had incomplete data, did not fulfill age criteria, or with missing data (**Figure 1**). The 26,263 remaining participants, consisting of 14,041 women and 12,222 men, were analyzed in this study. Around 62.1% of those aged 20 to 65 years experienced headaches at least once in the past four weeks. Participants with headaches were most likely female and married, educated (≥9 years), unemployed, and depressed. Comorbidities associated with headaches were hypertension, hypercholesterolemia, heart disorders, and sleep disturbance/poor sleep quality.

Table 2 shows the factors associated with headaches. In the adjusted logistic regression model, we found that in females, depression, hypertension, and sleep disturbance were significantly associated with headaches.

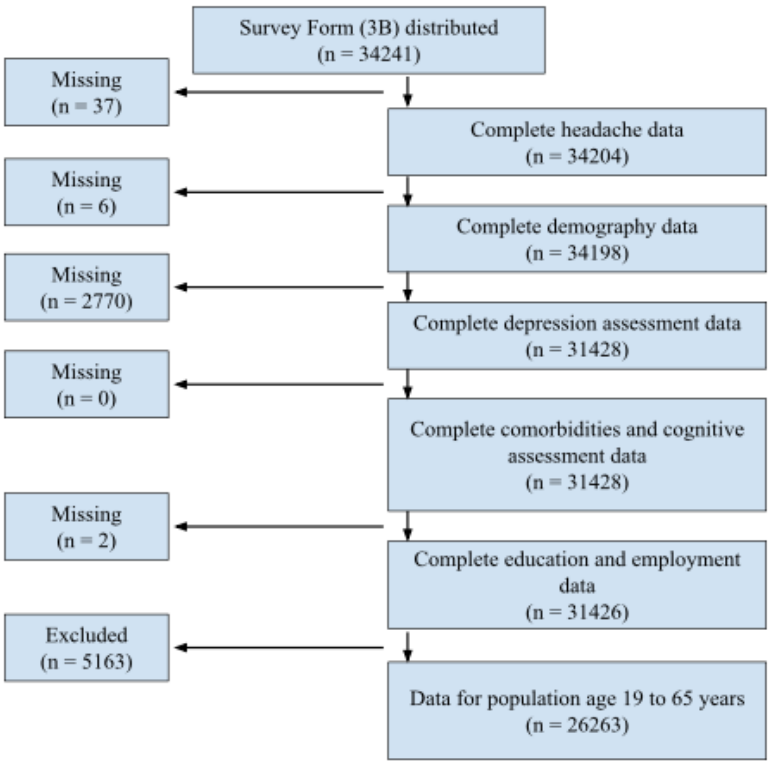

Figure 1. IFLS sampling process from initial distribution to data exclusion.
A total of 2,815 records were eliminated due to incomplete data, and an additional 5,163 were excluded because the persons were under the age of 19 years or over the age of 65 years

Table 2. Logistic regression analysis of the factors associated with headaches in the population aged 20 to 65 years.

Variables	p-value	Adjusted OR* (CI 95%)
Age 20 – 44 years	<0.001	1.32 (1.24-1.42)
Female	<0.001	1.64 (1.55-1.73)
Education ≥9 years	0.005	1.08 (1.03-1.15)
Lower income	0.001	1.12 (1.05-1.19)
Depression	<0.001	1.79 (1.64-1.92)
Hypertension	<0.001	1.79 (1.64-1.96)
Cholesterol	0.001	1.33 (1.15-1.52)
Often/sometimes sleep disturbance	<0.001	2.24 (2.11– 2.36)
Poor/moderate sleep quality	<0.001	1.22 (1.15-1.29)

OR=Odds ratio; CI=Confidence interval;*Adjusted for age, sex, education level, economic status, depression, hypertension, cholesterol, sleep disturbance, and sleep quality, when appropriate

DISCUSSION

In the present study, multivariate analysis showed that having sleep disturbance had the strongest association with the occurrence of headache, along with poor sleep quality but to a lesser extent. This finding is consistent with several most recent studies showing a significant positive association between headache occurrence and sleep disturbances, although the majority of these studies were conducted in adolescents.[5,10]

According to the American Migraine Foundation (AMF),[11] sleep loss of any cause (e.g. insomnia, sleep apnea, bruxism) and oversleeping are common headache triggers (i.e. hypnic or wake-up headache). In the International Classification of Sleep Disorders (ICSD), headache is listed among the symptoms of sleep disorders.[12] It is difficult to demonstrate a causal association in patients who suffer from both headaches and sleep disorders, therefore the relationship is typically bidirectional. Many of the

structures, processes, and neurotransmitters involved in sleep disturbances also play a role in headache pathogenesis. The structures comprise the thalamus, hypothalamus, locus ceruleus, and periaqueductal gray matter. Sleep problems and headaches induce and/or intensify each other in a complicated bidirectional manner, largely driven by the same neurological substrates and mediated by emotional and personality disorders.[13,14]

Depression was also associated with headache. Similar to sleep disturbance, studies have also shown that there is a bidirectional association between headache and depression. People with ongoing chronic headaches may become depressed because of the continuous pain, and conversely, people with depression may develop bodily symptoms, including headaches.[15,16] A systematic review by Leo et al.[17] showed that depression affects almost 80% of headache sufferers at some point in their life. People with chronic headaches, such as chronic migraines, were more likely to experience intense anxiety and depression. In severe cases, they might also develop suicidal thoughts/tendencies.

Hypertension showed a positive association with headaches. Headaches in hypertensive populations are often controversial. A recent cross-sectional cohort study by Gardener et al. [19] reported that controlled short duration hypertension was not associated with headaches, but uncontrolled hypertension, both of short and long duration, was associated with headache. The Headache Classification Committee of the International Headache Society (IHS) has also stated that mild chronic (140–159/90–99 mmHg) or moderate hypertension (160–179/100–109 mmHg) most likely does not cause headaches.[20] This has been supported by another study.[21] Many factors contribute to the development of headaches in hypertensive patients directly and indirectly: acute pain, increased intracranial pressure in hypertensive encephalopathy because of vasodilatation, and lastly, anti-hypertensive drugs may also cause headache as an adverse effect. Surprisingly, some agents used to treat migraine can also exacerbate hypertension.[22]

Women are also associated with headache occurrence. Headaches such as migraine or tension-type headache has a female preponderance, being 1.5 to 3 times more common in women than in men. In contrast, cluster headaches are more common among young adults and middle-aged men. This variance in sex-specific prevalence suggests that sex hormones could influence the course of headaches.[23] Because the IFLS data did not indicate the type of headache, it was unclear which type of headache was most common in the survey. A study by Stovner et al. [24] on 357 published papers showed similar results where the incidence of non-specific headache over 15 days/month (chronic daily headache) along with migraine was significantly higher among women than men, consistent with the results in the present study. Although migraine and tension-type headaches were the leading types in women, secondary diseases may also have caused the headaches in the present study.

Several other variables were statistically significant but seemed to have little to no clinical significance, as shown in the slight increase in the odds ratio. The extensive population in this study might affect the significance of the following variables: early adulthood (19 to 45 years), hypercholesterolemia, low income/economic status, higher education (>9 years), and poor sleep quality, for which reason careful interpretation is needed.

Our study found that early adulthood (19 to 45 years) had a higher prevalence of headaches than late adulthood (45 to 65 years). It has long been known that primary headaches are more common in adults than in the elderly. Migraine is common in late adolescence and early adulthood, with prevalence peaking in late teens and early twenties.[25] Tension-type headaches usually start at younger ages (the early 20s) and rarely after age 50 years.[26] Cluster headache is most common between 29.6 and 31.6 years.[27] Different types of headaches show different predisposing ages because of the underlying mechanism or pathophysiology. Although headaches in older adults are not uncommon, they often represent a different diagnosis than in younger persons, because headaches secondary to underlying or comorbid conditions become more prevalent with age.

Hypercholesterolemia might also contribute to headache development. Several studies have shown that the frequency and intensity of migraine, especially migraine with aura, were associated with increased cholesterol concentrations (total or LDL) compared to healthy subjects.[28] A recent observational cross-sectional study reported that elevated levels of serum total cholesterol and LDL cholesterol were more associated with migraine than with the non-migraine group. The groups with late-age migraine and migraine with aura also showed

significantly higher serum total cholesterol and LDL cholesterol.[29]

An individual's low economic status or income might also be associated with headaches. There has been debate about whether high or low socioeconomic level causes a higher prevalence of headaches, and numerous studies have yielded conflicting results. Various hypotheses could explain this disparity. There is a lack of research on headache in low- and low-middle sociodemographic index (SDI) populations. The majority of currently accessible studies and data were conducted in developed and high, high-middle, or middle SDI regions, hence a higher prevalence of headache appears to be associated with better economic status or income. People from low-income families, on the other hand, are less likely to obtain adequate information on primary headaches, leaving them ignorant or confused. Another possible factor is a lack of medical resources or the social causation hypothesis in which more abundant exposure to stressors in lower-income groups causes a higher incidence of headache and lower remission rate.[30,31]

A longer and higher education level (≥9 years) showed a slight increase in headache occurrence. This may be linked to other factors such as higher occupation/employment status, institutional and peer pressure, anxiety, and fatigue among college students. Several studies confirmed these findings, because college students tend to manage migraine with acute medications (higher risk of medication overuse headache), are at higher risk of mental health disorders (depression, anxiety), and have longer use of electronic devices.[32–34]

This study has several strengths compared to the other studies. First, our study findings can be considered to be highly representative of the Indonesian population, since this study used data from a large-population-based survey with a nationally representative sample. Therefore, this study can be used to give a first impression of headaches as a problem, consistent with the data from GBD. This study can also be a starting point for subsequent population-based studies. Second, since the IFLS is an ongoing national longitudinal survey, the protocols and technique of sampling have been standardized, with continuous adjustment and improvement from year to year. The instruments used to collect the data, such as depression scale and cognitive test, have also been validated and widely used.

However, our study also has several limitations. First, the type of headaches in this study was unclear, because the questions about chronicity, intensity, and characteristics of the symptoms were not included in the survey. Therefore, the diagnosis of primary headaches could not be made, and headaches from secondary causes could not be excluded. Second, the diagnosis of comorbidities (hypertension, hypercholesterolemia, and stroke) was self-reported data based on the participants' history. No further examinations or ancillary tests were done to confirm these diagnoses. Finally, it must be considered that the present data are cross-sectional. It will be an interesting follow-up project to investigate the relation of several risk factors of headaches.

The results of the present study may be useful for clinicians to implement a more comprehensive therapeutic strategy in patients with headaches of any cause after a complete clinical assessment and exclusion of red flags in headaches. Managing sleep disturbances, psychological distress, and other chronic systemic conditions is essential in reducing headaches. Education on sleep hygiene or sleep disturbance therapy should be considered in patients with a high level of headache.

CONCLUSION

This study demonstrated that sleep disturbances were the dominant risk factor for headaches in subjects aged 20 to 65 years. Furthermore, sleep disturbance treatment should especially be considered in patients with a high level of headache.

Conflict of Interest

Competing interests: No relevant disclosures.

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We thank RAND Corporation for making the data publicly available at http://www.rand.org/labor/FLS/IFLS.html.

Author Contributions

JB designed the study, collected the data, analyzed and interpreted the data, and was a major contributor in writing the manuscript. HS designed the study, analyzed and interpreted the data, and was a major contributor in writing the manuscript. IS designed the study, collected the data, and performed the majority of statistical analyses in this study. PS edited and reviewed the

data analysis of the manuscript. IW edited and reviewed the body of the manuscript. YT reviewed the final manuscript. All authors have read and approved the final manuscript.

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Data Availability Statement

Raw data that support the findings of this study are available from the corresponding author, upon reasonable request. Complete datasets from IFLS-5 are publicly available at http://www.rand.org/labor/FLS/IFLS.html

Declaration of Use of AI in Scientific Writing

The authors declare that they did not use artificial intelligence (AI) in the writing of this manuscript.

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