

Biopsychosocial Factors Associated with Sleep Quality Among Non-Agricultural Working-Age Adults

Woothikrai Chitaree

Chiang Klang Hospital

Pasiri Singhasiri

`pasiri.s@cmu.ac.th`

Chiang Mai University

Nida Buawangpong

Chiang Mai University

Wichuda Jiraporncharoen

Chiang Mai University

Kotchaporn Kuanthana

Chiang Klang Hospital

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Abstract

Background: Sleep quality is an important determinant of overall health and well-being. Lifestyle behaviours and sociodemographic characteristics may influence sleep quality. This study aimed to examine factors associated with good sleep quality among non-agricultural working-age adults.

Methods: A cross-sectional study was conducted in Chiang Klang District, Nan Province, Thailand. Data on sociodemographic characteristics, lifestyle behaviours, dietary intake, and clinical parameters were collected using structured questionnaires, health examinations, and laboratory investigations. Sleep quality was categorized as good or poor based on the Pittsburgh Sleep Quality Index (PSQI). Multivariable logistic regression was performed to explore associations with 95% confidence intervals (CIs).

Results: Of 273 participants, 179 (65.6%) reported good sleep quality and 94 (34.4%) reported poor sleep quality. Former alcohol consumption was more prevalent among those with poor sleep quality (19.15% vs. 8.38%, $p = 0.009$), as was high fat dietary intake (30.85% vs 16.20%, $p = 0.012$). In multivariable analysis, male sex, presence of underlying medical conditions, former alcohol consumption, and high fat intake were independently associated with lower odds of good sleep quality. In contrast, higher physical activity levels and educational attainment above secondary school were positively associated with good sleep quality.

Conclusions: Sleep quality among working-age adults was associated with multiple biopsychosocial determinants including biological factors (sex, underlying medical conditions), behavioural factors (former alcohol consumption, dietary fat intake, physical activity), and social factors (educational level). Promoting a biopsychosocial approach to sleep health and integrating sleep assessment into community-based primary care may help improve sleep health and overall well-being.

Background

Sleep problems have become an increasingly important global public health concern. Recent systematic reviews estimate that approximately 16% of adults worldwide experience clinically significant insomnia, representing more than 850 million people, while an even larger proportion report poor sleep quality.[1] Poor sleep adversely affects physical, psychological, and social well-being and is associated with an increased risk of non-communicable diseases (NCDs), unintentional injuries, reduced work productivity, and poorer quality of life. [2] Meta-analytic evidence further suggests that up to 40% of individuals in community-based populations experience poor sleep quality, underscoring the widespread burden of sleep-related problems across regions. [3] In Thailand, national surveys and community-based studies report that the prevalence of sleep problems among adults ranges from 25% to 38%, with higher rates among working-age individuals and urban populations. [4, 5] This pattern may reflect features of modern urban living, including occupational stress, long working hours, irregular sleep schedules, exposure to artificial light at night, and frequent digital device use, all of which can disrupt circadian rhythms and

impair sleep quality. [6, 7] Other contributing factors include alcohol consumption, smoking, insufficient physical activity, and electronic media use before bedtime. [8]

One important biological factor linked to sleep quality is metabolic syndrome (MetS), a cluster of metabolic abnormalities that includes central obesity, hypertension, hyperglycemia, and dyslipidemia. MetS substantially increases the risk of cardiovascular disease and type 2 diabetes mellitus, both of which are among the leading causes of death globally according to the World Health Organization (WHO). [9]. Its prevalence among adults is estimated at approximately 20% to 25%, and its burden continues to rise. In Thailand, data from the National Health Examination Survey (NHES) indicate that the prevalence of metabolic syndrome among adults is approximately 23.2%, with an increasing trend, particularly in urban areas and among working-age populations. [10] MetS is strongly associated with sedentary behaviour, energy-dense diets, and low levels of physical activity. These mechanisms play an important role in the development of insulin resistance and other components of metabolic syndrome.

Beyond biological mechanisms, poor sleep quality also has significant implications for psychological well-being. Evidence shows that inadequate or disturbed sleep is associated with increased stress, depressive symptoms, anxiety, impaired cognitive function, and reduced overall quality of life. [11–13] In modern societies, social and environmental conditions such as heavy workloads, irregular work schedules, and prolonged exposure to digital screens may further worsen sleep disturbances by disrupting normal circadian rhythms and sleep-wake patterns. [6] Following the coronavirus disease 2019 (COVID-19) pandemic, declared by the World Health Organization in 2020, working patterns changed substantially. [14] Remote work arrangements, increased screen time, and reduced physical activity contributed to higher sedentary behaviour and a global rise in sleep disturbances. [15] Non-agricultural working-age adults may be particularly vulnerable due to prolonged sitting, low occupational physical activity, and persistent work-related stress. In this population, sleep problems may result in reduced job performance, occupational injuries, emotional disturbances, and a greater long-term risk of NCDs. [2]

Despite growing evidence on the health consequences of poor sleep, studies that comprehensively examine the biological, psychological, and social factors associated with sleep quality among non-agricultural working-age adults in Thailand remain limited. Therefore, this study aimed to assess the biopsychosocial and behavioural factors associated with sleep quality in this population in order to inform holistic health promotion strategies and reduce the long-term risk of non-communicable diseases.

Methods

Study Design and Setting

This study used a cross-sectional design, conducted at the health examination clinic of Chiang Klang Hospital, a community hospital located in Chiang Klang District, Nan Province, Thailand. The clinic

provides annual health examinations and preventive health services for working-age adults in the district, with an average service volume of approximately 100 clients per week. Most attendees are employees from governmental and private organizations within the district.

Participants

The target population comprised working-age adults employed in non-agricultural sectors who attended the annual health examination service during the study period. Participants were recruited using convenience sampling from the daily registration list of eligible clients until the required sample size was achieved. Inclusion criteria were age between 20 and 59 years, employment in non-agricultural occupations, ability to communicate in Thai, and provision of written informed consent. Participants who were unable to complete the questionnaire despite assistance were excluded.

Data Collection Procedure

Data were collected between January 1 and February 28, 2026. Participants attending the annual health examination were scheduled through their affiliated organizations. As part of routine services, all participants underwent standard clinical assessments, including measurement of body weight, height, waist circumference, blood pressure, and laboratory investigations comprising fasting plasma glucose, triglycerides, and high-density lipoprotein cholesterol.

Eligible individuals were approached by a trained research assistant who was not involved in the provision of healthcare services, informed about the study objectives and procedures, and invited to participate. Written informed consent was obtained from all participants prior to data collection. Completion of the questionnaire took approximately 10–15 minutes. Participants completed the questionnaires independently; however, researcher-assisted interviews were conducted when necessary to ensure comprehension and completeness of responses.

Sample Size Calculation

The sample size was calculated using the single population proportion formula to estimate the prevalence of poor sleep quality among working-age adults. Assuming a prevalence of 30% based on previous Thai studies[16], a 95% confidence level ($Z = 1.96$), and a margin of error of 5%, the minimum required sample size was 246 participants. To account for potential incomplete data, the sample size was increased by 10%, yielding a final target sample size of 274 participants.

Ethical Considerations

The study protocol was approved by the Research Ethics Committee of the Nan Provincial Public Health Office, Thailand (Ethics approval number: 69 – 12). Written informed consent was obtained from all

participants prior to enrollment. Participant data were anonymized and stored securely to ensure confidentiality throughout the study.

Measurements

Data were collected using a structured questionnaire consisting of four domains, as follows:

1. Sociodemographic and Biological Factors

Information on age, sex, educational level, income, underlying illness, occupation, and job characteristics was collected using a structured questionnaire. Smoking status was assessed using the Fagerström Test for Nicotine Dependence [17] [18]. Alcohol consumption, including drinking frequency and quantity, was also recorded.

1. Physical Activity

Physical activity was assessed using the validated Thai version of the International Physical Activity Questionnaire-Short Form (IPAQ-SF) [19] [20]. Total physical activity was calculated in metabolic equivalent minutes per week (MET-min/week) according to the standard IPAQ scoring protocol. [21, 22] Participants were categorized into low, moderate, or high physical activity levels based on established criteria.

1. Dietary Behaviour

Dietary behaviours related to high sugar, fat, and sodium intake were assessed using a structured questionnaire developed in accordance with health promotion guidelines from the Thai Health Promotion Foundation and nutritional recommendations from the World Health Organization.[23–25] Total scores were calculated to categorize dietary behaviour into appropriate, moderate, or inappropriate levels.

1. Sleep Quality (Primary Outcome)

Sleep quality was assessed using the Thai version of the Pittsburgh Sleep Quality Index (PSQI), which has demonstrated acceptable reliability and validity[16]. The PSQI consists of seven components, generating a global score ranging from 0 to 21. A global PSQI score greater than 5 indicates poor sleep quality.

Statistical Analysis

Data were analyzed using Stata version 17 (StataCorp, College Station, TX, USA)[26]. Descriptive statistics were used to summarize participant characteristics. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as means with standard deviations for normally distributed data, and as medians with interquartile ranges (IQRs) for non-normally

distributed data. Differences between participants with good and poor sleep quality were assessed using the chi-square test for categorical variables and independent t-tests for continuous variables.

Multivariable binary logistic regression analysis was performed to identify biopsychosocial factors independently associated with sleep quality. Independent variables included in the multivariable model were selected a priori based on previous literature and theoretical relevance within the biopsychosocial framework of sleep health. These variables included age, sex, educational level, income, underlying medical conditions, smoking status, alcohol consumption, physical activity level, and dietary behaviours, which have been reported to influence sleep quality in adult populations.[27–30] Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. Statistical significance was defined as a *p*-value of less than 0.05.

Results

A total of 273 participants were included in the analysis. One participant had missing data for income and one for sex; therefore, analyses were conducted using available data for each variable. As the proportion of missing data was minimal (0.7%), complete-case analysis was performed. The baseline characteristics are presented in **Table 1**. Among all participants, 179 (65.6%) had good sleep quality, while 94 (34.4%) reported poor sleep quality. The mean age of participants was 42.45 ± 10.63 years, and the majority were female (63.97%). Most participants reported current alcohol consumption (72.2%), were non-smokers (83.9%), and had moderate levels of physical activity (41.8%). The median BMI was 23.05 kg/m² (IQR: 21.2–25.95). The distribution of underlying medical conditions did not differ significantly between groups (*p* = 0.093). Clinical parameters, including systolic blood pressure, waist circumference, triglycerides, HDL cholesterol, and fasting blood glucose levels, were comparable between the two groups with no statistically significant differences observed.

Several lifestyle factors showed statistically significant differences between participants with poor and good sleep quality. A higher proportion of former drinkers was observed among those with poor sleep quality compared with those with good sleep quality (19.15% vs. 8.38%, *p* = 0.009). Furthermore, fat intake was significantly associated with sleep quality; participants with poor sleep quality were more likely to report high fat intake than those with good sleep quality (30.85% vs 16.20%, *p* = 0.012). Conversely, a higher proportion of participants in the good sleep group reported moderate fat intake (74.86% vs 64.89%, *p* = 0.012).

Table 1 Baseline characteristics of participants by sleep quality (N = 273)

Characteristics	Total (N = 273)	Poor sleep quality (n = 94)	Good sleep quality (n = 179)	p- value
Female, n (%)	174 (63.9)	63 (67.7)	111 (62.0)	0.350
Male, n (%)	98 (36.0)	30 (32.2)	68 (37.9)	
Mean age, years $\pm$ SD	42.45 $\pm$ 10.63	41.36 $\pm$ 10.74	43.11 $\pm$ 10.56	0.193
Education, n (%)				0.227
Secondary school	90 (32.9)	34 (36.1)	56 (31.2)	
Bachelor's degree	169 (61.9)	58 (61.7)	111 (62.0)	
Above bachelor's degree	14 (5.1)	2 (2.1)	12 (6.7)	
Income, n (%)				0.707
5,000-10,000 THB	43 (15.8)	13 (13.9)	30 (16.7)	
10,000-20,000 THB	83 (30.5)	31 (33.3)	52 (29.1)	
>20,000 THB	146 (53.6)	49 (52.7)	97 (54.2)	
Smoking, n (%)				0.704
Never	229 (83.9)	77 (81.9)	152 (84.9)	
Current smoker	16 (5.9)	7 (7.4)	9 (5.0)	
Former smoker	28 (10.3)	10 (10.6)	18 (10.1)	
Alcohol use, n (%)				0.009
Never	43 (15.8)	9 (9.6)	34 (18.9)	
Current drinker	197 (72.2)	67 (71.3)	130 (72.6)	
Former drinker	33 (12.1)	18 (19.1)	15 (8.4)	
Underlying medical conditions, n (%)				0.093
Diabetes Mellitus type 2	220 (80.6)	71 (75.5)	149 (83.2)	
Hypertension	4 (1.5)	2 (2.1)	2 (1.1)	
Dyslipidemia	14 (5.1)	3 (3.2)	11 (6.1)	
Others	35 (12.8)	18 (19.1)	17 (9.5)	
Fat level, n (%)				0.012
Low	20 (7.3)	4 (4.3)	16 (8.9)	

Moderate	195 (71.4)	61 (64.9)	134 (74.9)	
High	58 (21.2)	29 (30.8)	29 (16.2)	
Sweet level, n (%)				0.440
Low	52 (19.1)	14 (14.9)	38 (21.2)	
Moderate	200 (73.3)	72 (76.6)	128 (71.5)	
High	21 (7.7)	8 (8.5)	13 (7.3)	
Sodium level, n (%)				0.200
Low	15 (5.5)	2 (2.1)	13 (7.3)	
Moderate	221 (80.9)	78 (82.9)	143 (79.9)	
High	37 (13.5)	14 (14.9)	23 (12.8)	
Physical activity, n (%)				0.161
Low	108 (39.6)	42 (44.7)	66 (36.9)	
Moderate	114 (41.7)	40 (42.5)	74 (41.3)	
High	51 (18.7)	12 (12.8)	39 (21.8)	
BMI, kg/m², median (IQR)	23.05 (21.20–25.95)	22.60 (20.80–26.00)	23.50 (21.29–25.60)	0.527
SBP, mmHg ± SD	120.79 ± 13.55	119.94 ± 13.88	121.23 ± 13.39	0.453
Waist circumference, cm ± SD	80.53 ± 10.16	80.82 ± 9.19	80.38 ± 10.66	0.733
Triglycerides, mg/dL, median (IQR)	98 (69–146)	98 (69–162)	94 (68–137)	0.318
HDL, mg/dL ± SD	60.30 ± 15.87	62.68 ± 18.98	59.06 ± 13.86	0.073
FBS, mg/dL ± SD	91.59 ± 10.15	90.49 ± 10.93	91.93 ± 9.72	0.442

Abbreviations: BMI, body mass index; SBP, systolic blood pressure; HDL, high-density lipoprotein; FBS, fasting blood glucose.

Missing data: income (n = 1), sex (n = 1)

The associations between demographic characteristics, lifestyle factors, and sleep quality were examined using univariable and multivariable logistic regression models, as detailed in **Table 2**. In the adjusted multivariable models, several demographic factors remained significantly associated with sleep quality. Male participants had lower odds of good sleep quality compared with female participants (aOR = 0.54; 95% CI: 0.32–0.90; p = 0.018). Conversely, participants with an educational level above secondary

school had higher odds of good sleep quality (aOR = 1.75; 95% CI: 1.03–2.97; p = 0.037). Moreover, the presence of underlying medical conditions was also independently associated with lower odds of good sleep (aOR = 0.76; 95% CI: 0.58–1.00; p = 0.047).

Regarding substance use, former alcohol consumption had significantly lower odds of good sleep quality across both models. A history of alcohol consumption showed significantly lower odds of good sleep quality compared to non-drinkers (Crude OR = 0.22; 95% CI: 0.05–0.97; p = 0.045). This negative impact remained robust and slightly intensified after adjusting for potential factors (aOR = 0.20; 95% CI: 0.05–0.71; p = 0.013). Smoking status also demonstrated a consistently negative trend toward good sleep quality, although not reaching statistical significance. Both former smokers (aOR = 0.74; 95% CI: 0.22–2.48; p = 0.630) and current smokers (aOR = 0.59; 95%CI: 0.29–1.22; p = 0.155) exhibited reduced odds of good sleep quality compared to non-smokers.

Higher physical activity was positively associated with good sleep quality, with participants in the high physical activity group having more than twice the odds of good sleep compared with those with low physical activity (aOR = 2.19; 95% CI: 1.10–4.35; p = 0.025). Conversely, high fat intake was associated with reduced odds of good sleep quality (aOR = 0.22; 95% CI: 0.05–0.90; p = 0.035). Additionally, BMI was positively associated with good sleep quality only after adjustment, with each unit increase corresponding to a 5% increase in the odds of good sleep (aOR = 1.05; 95% CI: 1.00–1.11; p = 0.033).

Table 2. Crude and adjusted odds ratios for factors associated with good sleep quality (N = 273)

Variables	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)	1.01 (0.99–1.03)	0.274	1.01 (0.98–1.05)	0.480
Male sex	0.78 (0.54–1.13)	0.183	0.54 (0.32–0.90)	0.018
Education above secondary school	1.37 (0.83–2.26)	0.219	1.75 (1.03–2.97)	0.037
Low income	1.25 (0.64–2.46)	0.509	0.99 (0.66–1.47)	0.941
Having underlying medical conditions	0.62 (0.34–1.12)	0.116	0.76 (0.58–1.00)	0.047
Alcohol consumption				
Current drinker	0.51 (0.14–1.87)	0.313	0.55 (0.13–2.40)	0.429
Former drinker	0.22 (0.05–0.97)	0.045	0.20 (0.05–0.71)	0.013
Smoking status				
Former smoker	0.65 (0.19–2.21)	0.491	0.74 (0.22–2.48)	0.630
Current smoker	0.91 (0.54–1.54)	0.731	0.59 (0.29–1.22)	0.155
Physical activity level				
Moderate	1.18 (0.71–1.94)	0.523	1.21 (0.57–2.57)	0.611
High	2.07 (1.18–3.64)	0.012	2.19 (1.10–4.35)	0.025
Sweet intake level				
Moderate	0.65 (0.36–1.18)	0.158	1.15 (0.55–2.40)	0.711
High	0.59 (0.28–1.29)	0.189	1.48 (0.79–2.79)	0.221
Fat intake level				
Moderate	0.55 (0.26–1.14)	0.108	0.46 (0.15–1.47)	0.191
High	0.25 (0.08–0.76)	0.014	0.22 (0.05–0.90)	0.035
Sodium intake level				
Moderate	0.28 (0.05–1.51)	0.140	0.24 (0.03–2.18)	0.205
High	0.25 (0.05–1.25)	0.093	0.21 (0.02–1.80)	0.153
BMI (kg/m ²)	1.03 (0.99–1.06)	0.106	1.05 (1.00–1.11)	0.033

Reference categories: female sex, educational at or below secondary school, normal income, no underlying illness, non-drinker, non-smoker, low physical activity, low sweet intake, low fat intake, and low sodium intake.

Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index.

Discussion

This study examines the biopsychosocial factors associated with sleep quality among non-agricultural working-age adults in a community hospital. The findings demonstrate that multiple factors are independently associated with sleep quality. In particular, male, the presence of underlying medical conditions, former alcohol consumption, and high fat intake are associated with lower odds of good sleep quality, whereas higher levels of physical activity and educational attainment above secondary school are positively associated with good sleep quality.

The prevalence of poor sleep quality in this study is 34.4%, which is comparable to that reported in previous studies conducted in similar populations. In the univariable analysis (Table 1), several lifestyle-related factors, particularly high dietary fat intake and alcohol consumption, are significantly associated with poor sleep quality. These findings are consistent with prior evidence suggesting that unhealthy dietary patterns and alcohol use may adversely affect sleep through metabolic and neurobehavioural mechanisms.

In the multivariable model, male participants have significantly lower odds of good sleep quality compared with females. Several mechanisms may explain this finding. Occupational stress, irregular working hours, and higher prevalence of behavioural risk factors among men may contribute to sleep disruption.[27, 31] Biological differences, including sex-related hormonal regulation and circadian rhythm patterns, may also influence sleep architecture. Sex hormones such as estrogen and progesterone have been shown to modulate sleep regulation through their effects on neurotransmitter systems and circadian rhythms, potentially contributing to differences in sleep duration and sleep stages between men and women. In addition, variations in melatonin secretion and circadian timing may further affect sleep-wake patterns and overall sleep quality across sexes. Collectively, these biological mechanisms suggest that sex-related physiological differences may partly explain variations in sleep quality observed in epidemiological studies.[32, 33]

In addition to sex-related mechanisms, emerging evidence highlights the role of poor sleep in metabolic dysregulation. Poor or insufficient sleep may contribute to metabolic dysregulation through several biological pathways, including alterations in leptin and ghrelin, activation of the hypothalamic-pituitary-adrenal axis (HPA) with elevated cortisol levels, increased sympathetic nervous system activity, and low-grade chronic inflammation marked by elevated interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α). [34]

The presence of underlying medical conditions is independently associated with lower odds of good sleep quality in this study. These conditions are predominantly related to metabolic syndrome (MetS), including hypertension, dyslipidemia, and diabetes. This finding is consistent with prior evidence indicating that poor sleep quality was associated with increased risks of obesity, type 2 diabetes, hypertension, and cardiovascular events[35]. Potential mechanisms including metabolic dysregulation,

systemic inflammation, and neuroendocrine alterations may have disrupted sleep. [36, 37] In addition, inadequate sleep is associated with insulin resistance, sympathetic overactivity, and changes in appetite-regulating hormones.[35] Conversely, insufficient or poor-quality sleep might have aggravated cardiometabolic disorders through dysregulation of hormonal pathways involving cortisol, leptin, and ghrelin.[36] Insufficient sleep is associated with metabolic dysregulation, and impaired immune function, which may contribute to disease progression.[38] Within a biopsychosocial framework, this bidirectional relationship between poor-quality sleep and metabolic syndrome[39] highlights the importance of incorporating sleep assessment into chronic disease management to identify modifiable risk factors and improve overall treatment effectiveness.[27, 28, 36, 37]

BMI is positively associated with good sleep quality after adjustment, with each unit increase in BMI associated with a modest increase in the odds of good sleep. This finding may reflect the relatively normal BMI distribution of the study population, where extremely low BMI is associated with occupational stress or health conditions affecting sleep.[40] However, previous studies generally report that obesity is associated with poor sleep quality and sleep disorders, including obstructive sleep apnea. [41]

Former alcohol drinkers show significantly lower odds of good sleep quality than non-drinkers. Although alcohol may initially facilitate sleep onset, it can disrupt sleep architecture, particularly by reducing REM sleep and increasing nocturnal awakenings.[42] Long-term alcohol exposure may also alter circadian rhythms and neurotransmitter pathways, leading to fragmented sleep and reduced sleep efficiency.[43, 44] Previous studies consistently report that alcohol consumption is associated with sleep fragmentation and poorer overall sleep quality[45].

Higher levels of physical activity are positively associated with good sleep quality, with participants in the high physical activity group having more than twice the odds of good sleep compared with those in the low physical activity group. Physical activity is known to improve sleep latency, sleep efficiency, and overall sleep duration through both physiological and psychological mechanisms.[46] Exercise may enhance sleep by regulating circadian rhythms, reducing stress, and improving metabolic health.[46, 47] These findings are consistent with systematic reviews reporting that regular physical activity was associated with better sleep quality in adults.[48]

High fat intake is associated with lower odds of good sleep quality. Diets rich in fat may influence sleep through metabolic dysregulation, inflammatory pathways, and alterations in circadian rhythm.[49] Previous research suggests that high fat intake is associated with shorter sleep duration, lower sleep efficiency, and increased sleep disturbances.[50] Several physiological mechanisms may explain this relationship. High fat intake is associated with metabolic dysregulation and systemic inflammation, both of which may interfere with normal sleep regulation. In addition, dietary patterns rich in fat may disrupt circadian metabolic signaling and affect neurotransmitter pathways involved in sleep–wake regulation, potentially leading to shorter sleep duration and reduced sleep efficiency. In contrast, sweet intake and sodium intake are not significantly associated with sleep quality in the adjusted models.

Although age and income are not significantly associated with sleep quality in this study, previous literature suggests that social determinants such as socioeconomic status, working conditions, and psychosocial stress may indirectly influence sleep health.[51] Participants with educational levels above secondary school have significantly greater odds of good sleep quality. Higher education may improve sleep through pathways such as better health literacy, improved access to health information, and healthier lifestyle practices. Individuals with higher education may also be more aware of sleep hygiene principles, including maintaining regular sleep schedules, managing stress, and adopting healthy dietary patterns.[27] [52] These findings are consistent with previous epidemiological studies demonstrating that education is an important social determinant of sleep health. In primary care settings, assessment of patients' educational background may help clinicians tailor health education strategies related to sleep hygiene and lifestyle modification. [53]

Overall, this study suggests that sleep quality is shaped by a range of biopsychosocial factors, including lifestyle behaviours and underlying health conditions.[51] Incorporating sleep assessment into routine primary care might help identify individuals at risk of poor sleep at an early stage and support timely, patient-centered care. Primary care providers are well placed to address modifiable factors such as alcohol use, dietary habits, and physical activity, which may improve sleep health while also reducing the long-term risk of non-communicable diseases. Previous research has likewise recognized sleep health as a fundamental component of overall health and an important target for preventive care strategies[28, 54].

Together, these findings underscore the need to integrate sleep health into broader lifestyle modification and chronic disease prevention efforts in both primary care and workplace health promotion programs. [54, 55] Because the study population largely comprised working-age adults employed in public and community service sectors—including healthcare personnel, teachers, police officers, and primary healthcare workers—the results also support the development of workplace-based interventions. Measures such as sleep health education, promotion of regular physical activity, stress management programs, healthier food environments, and screening for alcohol use and sleep problems might help improve employee well-being and productivity[27, 55].

This study provides a comprehensive evaluation of lifestyle behaviours, cardiometabolic indicators, and sociodemographic characteristics associated with sleep quality in a community-based population. The use of multivariable logistic regression analysis allowed adjustment for potential confounders and facilitated the identification of independent associations between lifestyle factors and sleep quality. In addition, the integration of behavioural, metabolic, and social determinants reflects a biopsychosocial framework consistent with the holistic approach commonly applied in family medicine and primary care. However, some limitations should be considered when interpreting the findings. First, the cross-sectional design limited the ability to establish causal relationships between lifestyle behaviours and sleep quality. Second, data on sleep quality and lifestyle factors were obtained through self-reported measures, which may be subject to recall bias or social desirability bias. Third, the study population was limited to working-age adults, which may limit the generalizability of the findings to other age groups or

occupational populations. Finally, several potential determinants of sleep quality, such as mental health status, occupational stress, and screen time, were not assessed and may have influenced sleep outcomes.

Conclusion

Sleep quality among working-age adults was independently associated with multiple biopsychosocial factors, including sex, educational level, underlying diseases, alcohol consumption, physical activity, and dietary fat intake. These findings underscore the role of modifiable lifestyle behaviours as key determinants of sleep health. Integrating sleep assessment and targeted lifestyle interventions into primary care and workplace health promotion programs may represent practical strategies to improve sleep quality and overall well-being. However, longitudinal studies are warranted to confirm causal relationships.

Abbreviations

PSQI: Pittsburgh Sleep Quality Index

BMI: Body mass index

SBP: Systolic blood pressure

HDL: High-density lipoprotein

FBS: Fasting blood sugar

IPAQ-SF: International Physical Activity Questionnaire – Short Form

MET: Metabolic equivalent

NCDs: Non-communicable diseases

MetS: Metabolic syndrome

IL-6: Interleukin-6

TNF- α : Tumor necrosis factor-alpha

Declarations

Ethics approval and consent to participate

This study was approved by the Research Ethics Committee of the Nan Provincial Public Health Office, Thailand (No. 69-12) and was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained, and confidentiality was maintained.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request (contact PS).

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors' contributions

Woothikrai Chitaree (WC) designed the study, developed the research questionnaire, conducted the literature review and summarized previous studies, interpreted the findings, and drafted the initial manuscript. Pasiri Singhasiri (PS) performed the statistical analysis and summarized the research findings. Nida Buawangpong (NB) performed statistical analysis and contributed to manuscript revision. Wichuda Jiraporncharoen (WJ) contributed to manuscript revision. Kotchaporn Kuanthana (KK) assisted with data collection. All authors read and approved the final manuscript

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