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Association between Nutritional Status and Sleep Quality among Community Dwelling Older Adults in Selected Rural and Peri-Urban Areas of Dhaka District, Bangladesh: A Cross-Sectional Study

Md. Abid Bin Siddique

abidbinsiddiq6@gmail.com

Department of Public Health & Informatics, Jahangirnagar University https://orcid.org/0000-0003-2014-0038

Md Ebrahim Howlader

Jahangirnagar University

Md Jamil Hossain

Jahangirnagar University https://orcid.org/0009-0005-2969-3271

Imtiaz Ahmed Sagor

Department of Public Health & Informatics, Jahangirnagar University

Lakshmi Rani Kundu

Department of Public Health & Informatics, Jahangirnagar University https://orcid.org/0000-0002-3528-0108

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Abstract

Background:

Poor Sleep Quality and nutritional vulnerability are prevalent among older adults, yet evidence on their interrelationship in Bangladesh remains overlooked. This study therefore aimed to assess the association between nutritional status and sleep quality among community dwelling older adults in selected rural and peri-urban areas of Dhaka, Bangladesh.

Methods:

We conducted a community-based cross-sectional study among 500 adults aged 60 years or older in Savar and Dhamrai between August and September 2023. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and nutritional status was evaluated using the Mini Nutritional Assessment–Short Form (MNA-SF). Multivariable linear and quantile regression models were used to examine the association between continuous MNA-SF and PSQI scores. Binary logistic regression estimated associations between nutritional-status categories and poor sleep quality.

Results:

Overall, 60.8% of participants had poor sleep quality, 53.8% were at risk of malnutrition, and 37.4% were malnourished. In the adjusted linear model, each one-point increment in MNA-SF score was associated with a 0.405-point lower PSQI score (β = -0.405; 95% CI: -0.584–0.226). Significant inverse associations were also evident at the 10th, 25th, 50th and 75th PSQI quantiles. In adjusted logistic regression model, compared with well-nourished participants, malnourished participants had higher adjusted odds of poor sleep quality (aOR = 3.75; 95% CI = 1.77–7.95), as did those at risk of malnutrition (aOR = 2.33; 95% CI = 1.14–4.76).

Conclusion:

Poor sleep quality and nutritional vulnerability were pervasive among the community-dwelling older adults of Savar and Dhamrai. Poorer nutritional status was independently associated with poor-sleep quality after adjusting all the relevant covariates. Longitudinal studies are needed to establish temporality and elucidate the potential causal pathways.

Introduction

Globally, the population is ageing at an accelerated pace across both developing and developed countries (1), largely advances in health care and public health have increased life expectancy over recent decades (2). The United Nations (UN) projects that the population aged 60 years or older will

increase from 1.2 billion in 2024 to 2.1 billion by 2050 (3). Bangladesh is undergoing a similar demographic transition, where life expectancy increased from 57.5 years in 1990 to 72.3 years in 2023(4) and almost 10% of the population is now aged 60 years or older (5). This transition is accompanied by a substantial burden of sensory impairment, musculoskeletal conditions, chronic obstructive pulmonary disease (COPD), diabetes, depression, and dementia among older adults (6). To preserve functional capacity and mental health wellbeing in later life is therefore an increasingly salient public health priority (7).

Sleep disturbances are among the most common health problems affecting older adults (8), including insomnia, fragmented sleep, altered sleep duration, and conditions such as restless legs syndrome and sleep-disordered breathing (9)(10). Poor sleep quality has been shown to adversely affect quality of life and is associated with numerous adverse health outcomes, including cognitive decline, cardiovascular disease, increased risk of falls, functional impairment, and mortality (11–15). Additionally, it may substantially impair daily performance in both social and professional aspects (16). The prevalence of poor sleep quality among older adults varies widely across settings, ranging from 10% to 62% globally (8). In 2014, a study conducted in Bangladesh reported approximately 39.2% of older adults suffer from insomnia (17). Malnutrition is another common health concern among older adults worldwide. Around one-third of the global elderly population is at risk of malnutrition (18), owing to a range of factors such as physiological changes, chronic illnesses, psychological stress, and loss of appetite (19).

Although poor sleep-quality and malnutrition are both common among older adults, evidence regarding their interrelationship in Bangladesh remains limited. Previous Bangladeshi studies have primarily examined sleep duration during COVID-19 pandemic (20), insomnia (17), psychological conditions (21). Furthermore, previous studies have generally examined mean or binary sleep outcomes without assessing how the nutritional-status association varies with sleep quality. Therefore, this study primarily aimed to examine the association between nutritional status and sleep quality among community-dwelling older adults in selected rural and peri-urban areas of Dhaka district. Secondary objective was to estimate the prevalence of poor sleep quality and nutritional vulnerability. The findings of this study may contribute important data-driven new insights in mitigating the vulnerability among older adults and to inform the development of public health strategies by policymakers and gerontologists in Bangladesh and other lower- and middle-income countries (LMICS).

Methods

Study Design, Population and Settings

A community-based cross-sectional study was conducted between 1 August and 15 September 2023 among older adults aged 60 years or older residing in selected rural or peri-urban settings of Savar and Dhamrai upazilas. Pathalia union under Savar, was selected to present predominantly peri-urban in character. Shombag and Kushura unions under Dhamrai, were selected as the rural setting. The communities in these unions were selected purposively based on accessibility and contrasting

residential characteristics. Eligibility criteria of the participants were, including aged 60 years or older; permanent residents of the study areas; could provide consent of the interview. Exclusion criteria were, including severe illness during the time of interview, severe illness or communication impairment, and inability to stand.

Sample Size Calculation

The sample size was calculated using the single-population proportion formula. Assuming a prevalence of poor sleep quality of 50%, a 95% confidence level, and a 5% of margin of error, the minimum required sample size was 384. To target was increased to 500 to improve precision and allow for incomplete responses.

Data Collection and Measurements

Data were collected through face-to-face interviews using a structured questionnaire consisting of four sections. The first section included questions on socio-demographic characteristics, and anthropometric measurements including weight and height. The second section assessed dietary diversity; the third section evaluated the nutritional status; and the fourth section assessed sleep quality of the older adults.

Assessment of Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) is a broadly used instrument in epidemiological studies for measuring sleep quality (22). The PSQI consists of 19 items designed to assess seven sleep patterns of previous one month, including subjective sleep quality, sleep duration, sleep latency, habitual sleep efficiency, sleep disturbance, daytime dysfunction, and use of sleep medications (23). Each of the seven PSQI components is scored from 0 to 3, and the scores are summed to generate an overall PSQI score ranging from 0 to 21. A global PSQI score of greater than 5 is defined as poor sleep quality, whereas a score of 5 or below indicates good sleep quality (24). This tool already has been validated (25) and used in previous studies of Bangladesh (26,27).

Assessment of Nutritional Status

The Mini Nutritional Assessment-Short Form (MNA-SF) is a well-established, simple and rapid screening tool for assessing the nutritional status of older adults, particularly identifying malnutrition and at risk in this population (28) (29). The MNA-SF contains six domains, including involuntary weight loss over the past three months, mobility, body mass index (BMI) or calf circumference (CC), problems with appetite or food intake during the last three months, psychological stress or acute illness during the last three months, and either suffering from neuropsychological issues (dementia or depression) (30). Total MNA-SF score ranges from 0 and 14, with scores of 0 – 7 indicating malnutrition, 8 – 11 indicating risk of malnutrition, and 12 – 14 indicating normal nutritional status (31).

Assessment of Dietary Diversity

The Dietary Diversity Score (DDS) was used to assess the dietary diversity of the participants based on prior studies employing a cut-off value of 5 to categorize dietary diversity, with a DDS of (≥5) indicating high dietary diversity and a DDS of <5 indicating low dietary diversity (32,33). DDS was calculated based on the consumption of 10 food groups: fresh fruits, fresh green leafy vegetables, preserved fruits or vegetables or pickles, meat (cow, chicken, goat, duck or others), fish, lentils or pea or chickpea, eggs, spices, dairy products, and dry seeds products on a recall method. For fruits and vegetables, response options were almost every day, often, sometimes, and rarely. Besides, the remaining food groups, response option were almost every day, at least once a week, at least once a month, occasionally, and rarely. Responses indicating frequent consumption, such as almost every day, often, or at least once a week were scored as 1, whereas less frequent consumption, including at least once a month, occasionally, and rarely, was scored as 0.

Explanatory Variables

The explanatory variables included participants' socio-demographic characteristics, lifestyle-related habits, physical activity, anthropometric measurement. Socio-demographic variables comprised age, sex, marital status, educational attainment, employment status, place of residence, etc. Individual lifestyle-related variables, including smoking habit, betel leaf habit, smokeless tobacco use, tea or coffee consumption, and alcohol intake. Physical activity was assessed by asking participants about the average amount of time spent per day engaging in vigorous physical activity (VPA), such as brisk cycling, heavy lifting, or digging, and light physical activity (LPA), such as cooking, cleaning, ironing, dusting, and putting away groceries. Health-related variables, including the presence of chronic health issues based on the subjective perception, the number of medications currently taken.

Statistical Analysis

Prior to analysis, the data set was thoroughly assessed for completeness, data quality, and potential outliers to ensure analytical accuracy. Descriptive statistics were used to summarize the variables such as categorical variables were shown as frequencies and percentages, and continuous variables were summarized as mean and standard deviation (SD). Differences in sleep quality status across categorical variables were assessed using the Pearson chi-square test. For continuous variables, the Mann-Whitney U test (Wilcoxon rank sum test) was used whether the normality assumptions were not met, whereas the independent-sample t-test was applied for normally distributed variables. Moreover, the PSQI score was not normally distributed; therefore, a quantile regression was fitted with at 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles and estimated as covariate effects at multiple points of the outcome variable. For comparison, a multiple linear regression model was also fitted by considering model assumptions such as linearity, homoscedasticity, multicollinearity, were assessed. Covariates were selected based on previous literature, and their theoretical and empirical relevance to sleep quality. In addition, binary logistic regression was performed to examine the association between sleep quality and level of nutritional status. All statistical analyses were carried out with STATA (version 15.1) and R Studio was

used to visualize the data. In order to test our hypothesis, we set $p < 0.05$, with confidence intervals calculated at the 95% level.

Ethical standard

The study protocol was approved by the Biosafety, Biosecurity, & Ethical Committee of the Faculty of Biological Sciences, Jahangirnagar University, Bangladesh [Ref. No: BBEC, JUlM2025l06 (276)]. Participants were informed about the study objectives, procedures, potential risks and benefits, volunteer participation, and confidentiality. The study was conducted in accordance with the Declaration of Helsinki.

Results

Socio-demographic, individual, and health related information

Table 1 presents the sociodemographic, individual habits, and health-related characteristics of the participants. A biggest proportion of the participants (36.6%) belonged to the 60 to 64 years age group and the mean age of the participants was 67.35 years (SD = 6.64). Overall, 57.6% were male, 60.8% had no formal education, 69.0% were married, and 58.4% were not engaged in any income-generating activity. Regarding individual habits, 58.2% of participants had never smoked. However, the majority had either a current or former smokeless tobacco habit (59.6%), betel leaf consumption (68.2%), and tea or coffee habit (69.4%).

In terms of physical activity, the mean daily duration (±SD) of light physical activity (LPA) was 3.45= (±2.33) hours, while the mean vigorous physical activity (VPA) was 1.03 (±1.84) hours. A statistically significant difference was observed between sleep quality and physical activity, including LPA and VPA (p value < 0.05). Furthermore, 66.8% of participants had more than three comorbidities and comorbidity been significantly associated with sleep quality (p value < 0.05). Notably, 70.1% of participants with poor sleep quality belonged to the group with more than three comorbidities. In addition, 64.0% of participants reported taking medications regularly, with a mean (±SD) number of regular medications of 1.72 (±1.94). A statistically significant difference was found between sleep quality and the number of regular medications taken ($p < 0.05$). The mean (±SD) number of medications was 1.85 (± 1.96) for poor sleep quality, compared with 1.51 (± 1.89) among good sleepers.

With respect to dietary and nutritional status, 52.8% of participants had a lower Dietary Diversity Score (DDS). Sleep quality was significantly associated with DDS status, and 56.6% of participants with poor sleep quality were from the lower DDS category. 53.8% of participants at risk of malnutrition and 37.4% showed malnourished.

Association between the PSQI score and MNA-SF score

Table 2 presents the associations of PSQI score and MNA-SF score and other explanatory variables using both Ordinary Least Square Regression (OLS) model and quantile regression. A multivariable

quantile regression was fitted at the 10th, 25th, 50th, 75th, and 90th quantiles of the PSQI score to examine whether these associations varied across the distribution of sleep quality. The pseudo-R^2 values ranged from 0.070 to 0.231, indicating modest model fit, the magnitude of the coefficient was larger at higher quantiles.

A significant negative association was observed between PSQI score and MNA-SF score in both OLS and quantile regression models. In the adjusted OLS model, each one-unit increase in MNA-SF score was associated with a 0.405 unit decrease in PSQI score (β= -0.405 95% CI: -0.584 to -0.226), suggesting that better nutritional status was associated with better sleep quality. Similar significant negative associations were observed at 10^{th}, 25^{th}, 50^{th}, and 75^{th}, though the association was not significant at the 90^{th} quantile.

A positive significant association was found between residential status and PSQI score. This association was progressively stronger at higher quantiles, with coefficients increasing from 1.09 at the 10^{th} quantile to 4.26 at the 90^{th} quantile. A similar trend also observed in OLS, suburban residents consistently showed higher PSQI scores, than rural residents (β=2.26; 1.58 - 2.94). Higher BMI was positively associated with PSQI in the 10^{th} and 50^{th} quantiles, indicating worse sleep quality with higher BMI score and similar result was found in the OLS. Moreover, the number of regular medications was also positively associated with the PSQI score in OLS model (β=0.210), and this relationship was more pronounced at the 75th and 90th quantiles, suggesting that number of taking medicines may be particularly relevant with participants with poorer sleep.

Light Physical Activity (LPA) was inversely associated with PSQI score in the OLS model (β= -0.196), indicating greater LPA with better sleep quality. This negative relationship was stronger at the higher quantiles. In contrast, vigorous physical activity (VPA) was not significantly associated with PSQI score in OLS, though a positive significant association was observed at the 90th quantile, suggesting the gradual increasing trend of β at quantiles model indicating an unexpected finding that the VPA increases the probability of poor sleep habit unlike LPA. Finally, the dietary diversity score (DDS) score showed a significant negative association with PSQI score only at the 90^{th} quantile (β= -0.030), indicating that better dietary diversity may be associated with improved sleep quality.

Association between nutritional status and sleep quality

Table 3 presents the association between sleep quality and nutritional status of community dwelling older adults at Dhaka district. In the unadjusted model (Model A), malnourished older adults had 3.91 timed higher odds of poor sleep quality than well-nourished participants (OR = 3.91; 95% CI: 1.97-7.75). Participants at risk of malnutrition also had significantly higher odds of poor sleep quality (OR = 2.12; 95% CI: 1.10-4.08). These associations persisted in Model B after adjustment for age, sex, marital status, employment status, educational attainment, place of residence, and living arrangement. Similarly, in the fully adjusted model with adjusting all of the covariates (Model ^{c}), malnutrition remained significantly associated with higher odds of poor sleep quality (AOR = 3.75; 95% CI = 1.77-7.95), as did being at-risk of

malnutrition (AOR = 2.33; 95% CI = 1.14, 4.76). Overall, the findings indicate a graded association, with the highest odds of poor sleep quality observed among malnourished participants.

Discussion

Poor sleep quality is an important, yet overlooked, dimension to ensure healthy aging concept, particularly in resource-constrained settings where evidence on its nutritional correlates remains scarce. Therefore, this study investigated sleep quality and its association with nutritional status and other significant determinants among older adults living in rural and suburban areas of Dhaka district, Bangladesh. Poor sleep quality was highly prevalent in the study population, affecting 60.8% of participants. In parallel, a substantial proportion of participants were nutritionally vulnerable, with 37.4% classified as malnourished, 53.8% as being at risk of malnutrition. The findings demonstrated a significant inverse association between PSQI score and MNA-SF score in both the quantile regression and multivariable linear regression, indicating that better nutritional status was consistently associated with better sleep quality across much of the PSQI distribution. In addition, the logistic regression showed malnourished participants and those at risk of malnutrition had significantly higher odds of poor sleep habit than their well-nourished counterparts. Collectively, these findings delineate a substantial co-burden of nutritional vulnerability and poor sleep quality among older adults residing at rural and peri-urban settings of Dhaka district.

The reverse association between nutritional status and sleep quality accords with findings from the Yiwu Elderly Cohort in China (33). Several biological pathways could plausibly underpin this association. Evidence showed malnutrition compromise brain physiology through deteriorating white matter, and leading to neurodegenerative disorders particularly among adolescents (34). Nutritional deficiencies, particularly inadequate tryptophan intake, may influence melatonin synthesis and dysregulate sleep patterns (35). Conversely, poor sleep quality may also contribute to malnutrition by disrupting energy balance and calorie spending (36). Additionally, sleep disturbances can also dysregulate appetite-regulating hormones, including lower leptin and spiking ghrelin concentrations, with downstream consequences for appetite and metabolism (37). These mechanisms remain provisioned in the context of our cross-sectional findings and warrant evaluation in longitudinal studies.

The present study revealed 60.8% of participants experienced poor sleep quality. This estimate was lower than the 82% prevalence of insomnia reported in a recent Bangladeshi study, but was broadly commensurate with estimates from Saudi Arabia and India, where approximately 66% of older adults experienced sleep-related problems (38,39). Lower estimates, ranging from 27.7% to 44.0%, have been documented in China, South Korea, and northern Thailand (40–43). Such heterogeneity could reflect differences in measurement instruments, population composition, sampling strategies, and socio-cultural context.

The current study also found 37.4% of participants were at malnourished, and a further 53.8% were at risk of malnutrition. This burden proportion of malnutrition appeared to be higher than findings reported

in earlier national as well as international studies. In 2021, a study conducted in some villages of Dhaka district showed 28.6% of older adults were malnourished, though the prevalence of at risk of malnutrition had higher a prevalence with 65.3% (44). Moreover, in 2022 another study conducted in rural areas of Bangladesh reported 30.3% of older individuals were malnourished (45). Some recent international, and sub-continental evidences also showed a substantial variation in nutritional status among older populations. A systematic review showed globally, the prevalence of malnutrition is 18% (CI: 16 to 21%) among older adults (46). Moreover, another previous systematic review in India reported 18% and 48% of elderly people are suffering from malnutrition and at risk of malnutrition, respectively (47). A study conducted in Hong Kong reported that nearly 30% of older adults were at risk of malnutrition (48), whereas a markedly higher prevalence of malnutrition with 48.1% documented in Ethiopia (49).

The present study identified both light and vigorous physical activity were significantly associated with PSQI scores. This finding is line with the study by Inoue et al. (2013) reporting older Japanese adults who did not do regular or frequent physical activity had a higher likelihood of insomnia (50). The beneficial role of physical activity in sleep may be explained through several mechanisms, including releasing endorphins stabilizing stress and anxiety, consequently result relaxation and good sleep, regulating rhythms of circadian, influencing body temperature, all of which may contribute to better sleep initiation and overall sleep quality (51,52). Additionally, residential status showed a significant association with sleep habits, as semi-urban participants had higher PSQI scores than rural counterparts. One possible reason might be that the majority of older adults in rural Bangladesh are more likely to engage in physically demanding activities, such as farming, agricultural work, than those living in urban or peri-urban areas, which may contribute to better sleep habits. However, contrasting evidence were explored in a meta-analysis of Chinese older adults reporting rural elderly individuals grew more sleep disturbances than urban (53). Similar finding was also reported by Delbari et al. (2024) among Iranian older adults (54).

Furthermore, a significant relationship was observed between number of regular taking medicines and PSQI scores, consistent with findings from studies conducted among older adults attending a public hospital in South India (55) and hospitalized elderly in Malaysia (56). Additionally, previous studies showed that majority of drugs, including antidepressants, antihypertensives, corticosteroids, decongestants, caffeinated analgesics, antiepileptics, and diuretics have been attributed directly to poor sleep quality (57). With regard to dietary diversity, the present study identified dietary diversity as negatively associated with PSQI scores, suggesting that greater dietary diversity increases better sleep quality. This finding is in line with pervious several studies conducted in Japan by Kurotani et. al., (2015) (58), and in south Australia (2017) by Cao et. al. (59), and national wide survey by Muhammed T. et. al. (2024) in India (60). One possible explanation might be inadequate sleep may often contribute the likelihood of consuming unhealthy or high calorific snacks or foods, particularly during nighttime hours.

To summary, this study explored new insights regarding the association between sleep quality and nutritional status among older adults residing at rural and peri-urban areas of Dhaka district. In response

to the urgent actions for older adults, these findings may play as ace in addressing sleep related health issues in future.

Strengths and Limitations

This study has several strengths. To the best of the author's knowledge, this is the first study to examine the relationship between sleep quality and nutritional status among community-dwelling older adults from both rural and peri-urban perspectives. Another key strength is the use of validated tools to measure both nutritional status and sleep quality, and both continuous and categorical formulations of the main exposure and outcome were analyzed. In addition, by applying the quantile we could evaluate how the outcome variable was varied in every quantile. Finally, the relatively large sample of older adults enhanced statistical power.

However, several limitations of the present study should be acknowledged. First, the cross-sectional design precludes the establishment of causal relationship or temporal relationships between the outcome variables. Second, as the data were collected from a single district, the generalizability of the findings to the broader Bangladeshi populations may be limited. Third, the use of self-reported measures for lifestyle choices and sleep quality may have introduced recall and reporting biases. Fourth, important poor sleep quality, including sleep apnea, and narcolepsy couldn't be specifically assessed in this study. We applied convenient sampling that may have introduced selection bias and limit generalizability beyond the study areas. Additionally, although several covariates were adjusted for during analysis, the possibility of residual confounding from unmeasured factors such as psychological stress, or genetic predisposition, cannot be entirely excluded. Besides, sleep quality was measured on the basis of subjective rather than objective measurement tools. Future research should consider longitudinal and interventional study designs to better explore the causal pathways linking nutritional status and sleep health among older adults. Future research may be benefited by including older adults from a wider range of geographical settings to improve the generalizability of the findings. Additionally, intervention-based studies that focused on improving dietary practices, encouraging optimal physical activity, and supporting better medication management could offer valuable evidence for improving sleep quality and overall well-being among older individuals.

Conclusion

Poor sleep quality and nutritional vulnerability were highly prevalent among community-dwelling older adults residing in rural and peri-urban Dhaka district, Bangladesh. Lower MNA-SF scores were associated with higher PSQI scores, and participants who were malnourished or at risk of malnutrition had higher adjusted odds of poor sleep quality than those who were well nourished. Malnourished and at-risk older adults were more likely to experience poor sleep quality than their well-nourished counterparts. Additionally, this relationship associated with residential settings, low physical activity, number of regular taking medicines, higher dietary diversity, further indicate that sleep health is embedded within a broader constellation of nutritional, behavioral, and clinical factors. These findings

suggest an integrated healthy-aging by maintaining a good nutritional status, to ensure a better sleep habit of older adults by promoting daily physical activity, reducing higher dependency on medicines, improving dietary diversity, etc.

Abbreviations

BMI Body Mass Index

DDS Dietary Diversity Score

LPA Light Physical Activity

MNA-SF Mini Nutritional Assessment-Short Form

OSA Obstructive Sleep Apnea

PSQI Pittsburgh Sleep Quality Index

REM Rapid Eye Movement

SOL Sleep Onset Latency

SE Sleep Efficiency

SWS Slow Wave Sleep

TST Total Sleep Time

VPA Vigorous Physical Activity

WHO World Health Organization

Declarations

Ethics approval and consent to participate

The study protocol and data collection procedure were approved by the Biosafety, Biosecurity, & Ethical Committee of the Faculty of Biological Sciences, Jahangirnagar University, Bangladesh [Ref. No: BBEC, JUlM2025l06 (276)]. Before each interview, participants were informed about the study objectives and procedures, potential risks and benefits, the voluntary nature of their participation, and the confidentiality of their data. Verbal informed consent was then obtained from each participant before the interview commenced.

Consent for publication

All the authors were informed and gave full consent to publish this manuscript in this journal.

Availability of data and materials

Based on the corresponding author's approval, data can be shared with the authorized public health research organization by maintaining journal's data sharing policy.

Competing interests

All the authors declared that there is no any competing interest exist in this study.

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Authors contributions

MABS conceptualized the study and the analysis plan. MABS, MEH, MJH, and IAS engaged in data collection team training, supervision, curation, and overall quality. MABS contributed to the final analysis and wrote the interpretation of the findings. MEH, MJH, and IAS wrote the draft introduction and discussion. MABS wrote the methodology, abstract and conclusion and finalized the draft. LRK approved the draft and the statistical analysis.

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References

1. WHO (2011) The association of sleep quality and sleep duration with nutritional status in older adults: Findings from the WCHAT study. https://doi.org/10.1016/j.maturitas.2020.10.013. https://doi.org/
2. Al-Tal S, Alkhatib B, Agraib LM (2025) The Association Between Nutritional Status, Diet Quality, and Sleep Quality Among the Elderly in Jordan: A Cross-Sectional Study. J Aging Res. ;2025. https://doi.org/10.1155/jare/7358242
3. United Nations. World Population Prospects 2024 (2024) https://population.un.org/wpp/
4. Afrin S, Khan MMH, Haque MA (2025) Factors affecting the active aging situation in Bangladesh. Front Public Health 13:1517482. https://doi.org/10.3389/FPUBH.2025.1517482/BIBTEX

5. Bangladesh Facts and Figures - Healthy Ageing – 2025
6. WHO, Ageing (2025) and health. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health#:~:text=Common health conditions associated with,%2C diabetes%2C depression and dementia
7. Chonody JM (2021) In: Gu D, Dupre ME (eds) Anxiety About Aging BT - Encyclopedia of Gerontology and Population Aging. Springer International Publishing, Cham, pp 501–505. https://doi.org/10.1007/978-3-030-22009-9_592.
8. Gulia KK, Kumar VM (2018) Sleep disorders in the elderly: a growing challenge. Psychogeriatrics 18:155–165. https://doi.org/https://doi.org/10.1111/psyg.12319
9. Baglioni C, Battagliese G, Feige B, Spiegelhalder K, Nissen C, Voderholzer U et al (2011) Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. J Affect Disord 135:10–19. https://doi.org/https://doi.org/10.1016/j.jad.2011.01.011
10. Tatineny P, Shafi F, Gohar A, Bhat A (2020) Science of Medicine sleep in the elderly. Mo Med 117:490–495
11. Chen H-C, Su T-P, Chou P (2013) A Nine-Year Follow-up Study of Sleep Patterns and Mortality in Community-Dwelling Older Adults in Taiwan. Sleep 36:1187–1198. https://doi.org/10.5665/sleep.2884
12. Ramos AR, Gardener H, Rundek T, Elkind MSV, Boden-Albala B, Dong C et al (2016) Sleep disturbances and cognitive decline in the Northern Manhattan Study. Neurology 87:1511–1516. https://doi.org/10.1212/WNL.0000000000003168
13. Valenza MC, Cabrera-Martos I, Martín-Martín L, Pérez-Garzón VM, Velarde C, Valenza-Demet G (2013) Nursing homes: Impact of sleep disturbances on functionality. Arch Gerontol Geriatr 56:432–436. https://doi.org/https://doi.org/10.1016/j.archger.2012.11.011
14. Stone KL, Blackwell TL, Ancoli-Israel S, Cauley JA, Redline S, Marshall LM et al (2014) Sleep Disturbances and Risk of Falls in Older Community-Dwelling Men: The Outcomes of Sleep Disorders in Older Men (MrOS Sleep) Study. J Am Geriatr Soc 62:299–305. https://doi.org/https://doi.org/10.1111/jgs.12649
15. Elwood P, Hack M, Pickering J, Hughes J, Gallacher J (1978) Sleep disturbance, stroke, and heart disease events: evidence from the Caerphilly cohort. J Epidemiol Community Health 2006;60:69 LP – 73. https://doi.org/10.1136/jech.2005.039057
16. Léger D, Bayon V, Ohayon MM, Philip P, Ement P, Metlaine A et al (2014) Insomnia and accidents: cross-sectional study (EQUINOX) on sleep-related home, work and car accidents in 5293 subjects with insomnia from 10 countries. J Sleep Res 23:143–152. https://doi.org/https://doi.org/10.1111/jsr.12104
17. Khan MN, Mondal MNI, Hoque N, Islam MS, Shahiduzzaman M (2014) A Study on Quality of Life of Elderly Population in Bangladesh. American Journal of Health Research. Volume 2, Page 152. 2014;2:152–7. https://doi.org/10.11648/J.AJHR.20140204.18

18. Agarwal E, Miller M, Yaxley A, Isenring E (2013) Malnutrition in the elderly: A narrative review. Maturitas 76:296–302. https://doi.org/https://doi.org/ 10.1016/j.maturitas.2013.07.013
19. Fávaro-Moreira NC, Krausch-Hofmann S, Matthys C, Vereecken C, Vanhauwaert E, Declercq A et al (2016) Risk Factors for Malnutrition in Older Adults: A Systematic Review of the Literature Based on Longitudinal Data. Adv Nutr 7:507–522. https://doi.org/https://doi.org/10.3945/an.115.011254
20. Mistry SK, Ali AM, Ahmed MS, Yadav UN, Khan MS, Hossain MB et al (2021) Prevalence and correlates of total sleep time among the older adults during COVID-19 pandemic in Bangladesh. Sleep Epidemiol 1:100008. https://doi.org/10.1016/J.SLEEPE.2021.100008
21. Rahman M, Khan M, Fattah T, Tasnim Z, Das PR, Prattay KMR et al (2025) Prevalence and associated risk factors for depression, anxiety, insomnia, and loneliness among the geriatric population in Bangladesh: a cross-sectional study. BMC Psychiatry 25:1102. https://doi.org/10.1186/S12888-025-07500-0
22. Lo CMH, Lee PH (2012) Prevalence and impacts of poor sleep on quality of life and associated factors of good sleepers in a sample of older Chinese adults. Health Qual Life Outcomes 10. https://doi.org/10.1186/1477-7525-10-72
23. Zhang YS, Jin Y, Rao WW, Jiang YY, Cui LJ, Li JF et al (2020) Prevalence and socio-demographic correlates of poor sleep quality among older adults in Hebei province, China. Sci Rep 10. https://doi.org/10.1038/s41598-020-68997-x
24. research BP-C health nursing (2020) undefined The Pittsburg sleep quality index (PSQI) and associated factors in middle-school students: a cross-sectional study. pmc.ncbi.nlm.nih.govBKParkChild health nursing research. 2020•pmc.ncbi.nlm.nih.gov
25. Mondal H, Mondal S, Baidya C (2018) Comparison of perceived sleep quality among urban and rural adult population by Bengali Pittsburgh Sleep Quality Index. Adv Hum Biology 8:36. https://doi.org/10.4103/AIHB.AIHB_44_17
26. Islam MS, Rahman ME, Zubayer A, Al, Bhuiyan MRAM, Khan MKA, Hossain L et al (2021) Investigating Poor Sleep Quality and Associated Factors During the COVID-19 Pandemic: A Population-Based Survey in Bangladesh. Front Public Health 9:724520. https://doi.org/10.3389/FPUBH.2021.724520/BIBTEX
27. Jahan SM, Hossain SR, Sayeed UB, Wahab A, Rahman T, Hossain A (2019) Association between internet addiction and sleep quality among students: a cross-sectional study in Bangladesh. Sleep Biol Rhythms 17:323–329. https://doi.org/10.1007/S41105-019-00219-Y
28. Aging CS-JNH (2006) undefined Nutritional screening tools–How does the MNA compare. mna-elderly.comCC SieberJ Nutr Health Aging, 2006•mna-elderly.com
29. Soysal P, Veronese N, Arik F, Kalan U, Smith L, Isik AT. Mini Nutritional Assessment Scale-Short Form can be useful for frailty screening in older adults. TaylorFrancisP Soysal, Veronese N, Arik F, Kalan U, Smith L (2019) AT IsikClinical interventions in aging, 2019•Taylor & Francis. ;14:693–9. https://doi.org/10.2147/CIA.S196770

30. Kaiser MJ, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, Bauer JM, Ramsch C, Uter W, Guigoz Y, Cederholm T, Thomas DR et al (2009) P AnthonyJNHA-The J Nutr Health Aging 2009•Springer 13:782–788. https://doi.org/10.1007/S12603-009-0214-7
31. Sarikaya D, Halil M, Kuyumcu ME, Kilic MK, Yesil Y, Kara O et al (2015) Mini nutritional assessment test long and short form are valid screening tools in Turkish older adults. Arch Gerontol Geriatr 61:56–60. https://doi.org/10.1016/j.archger.2015.04.006
32. Aihemaitijiang S, Zhang L, Ye C, Halimulati M, Huang X, Wang R et al (2022) Long-Term High Dietary Diversity Maintains Good Physical Function in Chinese Elderly: A Cohort Study Based on CLHLS from 2011 to 2018. Nutrients 14. https://doi.org/10.3390/nu14091730
33. Jiang H, Ye L, Zhang S, Jin M, Wang J, Tang M et al (2023) The association between nutritional status and sleep quality of Chinese community-dwelling older adults. Aging Clin Exp Res. https://doi.org/10.1007/s40520-023-02479-8
34. Fleta Zaragozano J, Jiménez Vidal Á, Velilla Picazo M, González Castro G, Pina Leita I, Olivares López JL (2005) Anorexia nervosa and cerebral atrophy in adolescents. Med Clin (Barc) 124:571–572. https://doi.org/10.1157/13074136
35. Chaput JP (2014) Sleep patterns, diet quality and energy balance. Physiol Behav. ;134 C:86–91. https://doi.org/10.1016/j.physbeh.2013.09.006
36. Pagliai G, Dinu M, Casini A, Sofi F (2018) Relationship between sleep pattern and efficacy of calorie-restricted Mediterranean diet in overweight/obese subjects. Int J Food Sci Nutr 69:93–99. https://doi.org/10.1080/09637486.2017.1330405
37. Spiegel K, Leproult R, L'Hermite-Balériaux M, Copinschi G, Penev PD, Van Cauter E (2004) Leptin levels are dependent on sleep duration: relationships with sympathovagal balance, carbohydrate regulation, cortisol, and thyrotropin. J Clin Endocrinol Metab 89:5762–5771. https://doi.org/10.1210/JC.2004-1003
38. Alqahtani BA (2021) Association between physical frailty and sleep quality among saudi older adults: A community-based, cross-sectional study. Int J Environ Res Public Health 18. https://doi.org/10.3390/ijerph182312741
39. Jesudoss D, Lazarus R, Wahid R (2023) Insomnia and sleep quality among older people residing in old age homes at Andhra Pradesh, India. Int J Afr Nurs Sci 18. https://doi.org/10.1016/j.ijans.2022.100522
40. Dong X, Wang Y, Chen Y, Wang X, Zhu J, Wang N et al (2018) Poor sleep quality and influencing factors among rural adults in Deqing, China. Sleep Breath 22:1213–1220. https://doi.org/10.1007/S11325-018-1685-8
41. Wang P, Song L, Wang K, Han X, Cong L, Wang Y et al (2020) Prevalence and associated factors of poor sleep quality among Chinese older adults living in a rural area: a population-based study. Aging Clin Exp Res 32:125–131. https://doi.org/10.1007/S40520-019-01171-0/TABLES/3
42. Kim WJ, Joo WT, Baek J, Sohn SY, Namkoong K, Youm Y et al (2017) Factors Associated with Insomnia among the Elderly in a Korean Rural Community. Psychiatry Investig 14:400.

https://doi.org/10.4306/PI.2017.14.4.400

43. Thichumpa W, Howteerakul N, Suwannapong N, Tantrakul V (2018) Sleep quality and associated factors among the elderly living in rural Chiang Rai, northern Thailand. Epidemiol Health. https://doi.org/10.4178/EPIH.E2018018
44. Rahman KMT, Khalequzzaman M, Khan FA, Rayna SE, Samin S, Hasan M et al (2021) Factors associated with the nutritional status of the older population in a selected area of Dhaka, Bangladesh. BMC Geriatr 21:161. https://doi.org/10.1186/S12877-021-02068-2
45. Razon AH, Haque MI, Ahmed MF, Ahmad T (2022) Assessment of dietary habits, nutritional status and common health complications of older people living in rural areas of Bangladesh. Heliyon 8:e08947. https://doi.org/10.1016/j.heliyon.2022.e08947
46. Salari N, Darvishi N, Bartina Y, Keshavarzi F, Hosseinian-Far M, Mohammadi M (2025) Global prevalence of malnutrition in older adults: A comprehensive systematic review and meta-analysis. Public Health Pract 9:100583. https://doi.org/10.1016/J.PUHIP.2025.100583
47. Kushwaha S, Khanna P, Srivastava R, Jain R, Singh T, Kiran T (2020) Estimates of malnutrition and risk of malnutrition among the elderly (≥ 60 years) in India: A systematic review and meta-analysis. Ageing Res Rev 63:101137. https://doi.org/10.1016/J.ARR.2020.101137
48. Wong MMH, So WKW, Choi KC, Cheung R, Chan HYL, Sit JWH et al (2019) Malnutrition risks and their associated factors among home-living older Chinese adults in Hong Kong: Hidden problems in an affluent Chinese community. BMC Geriatr 19. https://doi.org/10.1186/s12877-019-1148-5
49. Shuremu M, Belachew T, Hassen K, Muluneh M, Mulunehshuremu@ S; Nutritional status and its associated factors among elderly people in Ilu Aba Bor Zone, Southwest Ethiopia:a community-based cross-sectional study. BMJ Open. 2023;13:67787. https://doi.org/10.1136/bmjopen-2022-067787
50. Inoue S, Yorifuji T, … MS-J of aging, 2013 undefined. Does habitual physical activity prevent insomnia? A cross-sectional and longitudinal study of elderly Japanese. journals.humankinetics.comS Inoue, T Yorifuji, M Sugiyama, T Ohta, K Ishikawa-Takata, H DoiJournal of aging and physical activity, 2013•journals.humankinetics.com
51. Ye J, Jia X, Zhang J, Guo K (2022) Effect of physical exercise on sleep quality of college students: Chain intermediary effect of mindfulness and ruminative thinking. Front Psychol 13:987537. https://doi.org/10.3389/FPSYG.2022.987537/TEXT
52. Exercising for Better Sleep | Johns Hopkins Medicine (2026) https://www.hopkinsmedicine.org/health/wellness-and-prevention/exercising-for-better-sleep. Accessed 30 Apr
53. Lu L, Wang S-B, Rao W, Zhang Q, Ungvari GS, Ng CH et al (2018) Behavioral Sleep Medicine The Prevalence of Sleep Disturbances and Sleep Quality in Older Chinese Adults: A Comprehensive Meta-Analysis. Behav sleep Med. https://doi.org/10.1080/15402002.2018.1469492
54. Delbari A, Ahmadi F, Zar A, Zandvakili A, Sadeghipour HR, Sims J (2024) Living in urban or rural environments affect the sleep quality of the elderly in Bushehr (Southern Iran): emphasizing the

active and inactive of the elderly. BMC Public Health 24. https://doi.org/10.1186/S12889-024-18747-9

55. Hamza SA, Saber HG, Hassan NAM. Relationship between Sleep Disturbance and Polypharmacy among Hospitailzed Elderly. 2019
56. Hamza S, … HS-EJ of, 2019 undefined. Relationship between sleep disturbance and polypharmacy among hospitailzed elderly. ejgg.journals.ekb.egSA Hamza, HG Saber, N HassanEuropean Journal of Geriatrics and Gerontology, 2019•ejgg.journals.ekb.eg
57. Alturki A, Alaama T, Alomran Y, open AA-J-B, Potentially inappropriate medications in older patients based on Beers criteria: a cross-sectional study of a family medicine practice in Saudi Arabia. bjgpopen.orgA Alturki, Alaama T, Alomran Y, Al-Jedai A, Almudaiheem H (2020) undefined G WatfaBJGP open, 2020•bjgpopen.org
58. Kurotani K, Kochi T, Nanri A, Eguchi M, Kuwahara K, Tsuruoka H et al (2015) Dietary patterns and sleep symptoms in Japanese workers: the Furukawa Nutrition and Health Study. Sleep Med 16:298–304. https://doi.org/10.1016/J.SLEEP.2014.09.017
59. Cao Y, Taylor AW, Wittert G, Adams R, Shi Z (2017) Dietary patterns and sleep parameters in a cohort of community dwelling Australian men. Asia Pac J Clin Nutr 26:1158–1169. https://doi.org/10.3316/INFORMIT.107169608712629
60. Muhammad T, Pai M, Ahire K, Sharma M (2024) Demographic, socioeconomic, and health correlates of sleep quality and sleep duration among community-dwelling older adults in India. BMC Psychiatry 24. https://doi.org/10.1186/S12888-024-06122-2

Tables

Table 1: Socio-demographic characteristics of the participants with sleep quality (n = 500).

Characteristics	n (%)	Good Sleep Quality	Poor Sleep Quality	*p* value
		196 (39.2)	304 (60.8)	
Socio-demographic information				
Age category				
60 to 64 years	183 (36.6)	70 (35.7)	113 (37.2)	0.488
65 to 69 years	161 (32.2)	69 (35.2)	92 (30.2)	
≥ 70 years	156 (31.2)	57 (29.1)	99 (32.6)	
Sex				
Male	288 (57.6)	119 (60.7)	169 (55.6)	0.254
Female	212 (42.4)	77 (39.3)	135 (44.4)	
Educational status				
No formal education	304 (60.8)	115 (58.7)	189 (62.2)	0.275
Primary or below	107 (21.4)	49 (25.0)	58 (19.1)	
Secondary or above	89 (17.8)	32 (16.3)	57 (18.7)	
Marital status				
Married	345 (69.0)	142 (72.5)	203(66.8)	0.181
Widowed and others	155 (31.0)	54 (27.5)	101 (33.2)	
Occupation				
Employed	208 (41.6)	75 (38.3)	133 (43.7)	0.224
Unemployed or retired	292 (58.4)	121 (61.7)	171 (56.3)	
Residential Status				
Peri-urban	244 (48.8)	76 (38.8)	168 (55.3)	**<0.001**
Rural	256 (51.2)	120 (61.2)	136 (44.7)	
Individual habit				
Smoking habit				
Current or former	209 (41.8)	85 (43.4)	124 (40.8)	0.568
Never	291 (58.2)	111 (56.6)	180 (59.2)	
Betel leaf habit				

Current or former	343 (68.6)	129 (65.8)	214 (70.4)	0.282
Never	157 (31.4)	67 (34.2)	90 (29.6)	
Smokeless tobacco consumption				
Current or former	298 (59.6)	109 (55.6)	189 (62.2)	0.145
Never	202 (40.4)	87 (44.4)	115 (37.8)	
Tea or coffee habit				
Current or former	349 (69.4)	135 (68.9)	214 (70.4)	0.718
Never	151 (30.2)	61 (31.1)	90 (29.6)	
Health related information				
Physical activity				
Light Physical Activity (LPA)	3.45 ± 2.33	3.75 ± 2.31	3.25 ± 2.33	**0.0014**
Vigorous Physical Activity (VPA)	1.03 ± 1.84	1.27 ± 1.91	.88 ± 1.77	**0.0004**
Number of comorbidities				
No comorbidities	19 (3.8)	13 (6.6)	6 (1.9)	**0.014**
≤ 3	147 (29.4)	62 (31.6)	85 (27.9)	
>3	334 (66.8)	121 (61.7)	213 (70.2)	
Currently taking medicines				
Yes	320 (64.0)	118 (60.2)	202 (66.5)	0.156
No	180 (36.0)	78 (39.8)	102 (33.5)	
Average number of taking medicine	1.72 ± 1.94	1.51 ± 1.89	1.85 ± 1.96	**0.029**
Diet Diversity Score				
Lower DDS	264 (52.8)	92 (47.0)	172 (56.6)	**0.035**
Higher DDS	236 (47.2)	104 (53.1)	132 (43.4)	
Nutritional status				
Well-nourished	44 (8.8)	27 (13.8)	17 (5.6)	**<0.001**
At risk of malnutrition	269 (53.8)	115 (58.7)	154 (50.7)	
Malnourished	187 (37.4)	54 (27.5)	133 (43.7)	

Table 2: Multivariable analysis of PSQI score and MNA score by linear regression and quantile regression modeling.

Pseudo R^2 = 0.0764 (10^{th} Quantile)						
Pseudo R^2 = 0.0701 (25^{th} Quantile)						
Pseudo R^2 = 0.1213 (50^{th} Quantile)						
Pseudo R^2 = 0.1213 (75^{th} Quantile)						
Pseudo R^2 = 0.2310 (90^{th} Quantile)						
Variables	**Multivariable linear Regression**	**Quantile regression**				
	***β* (95% CI)**	**10^{th} quantile *β* (95% CI)**	**25^{th} quantile *β* (95% CI)**	**50^{th} quantile *β* (95% CI)**	**75^{th} quantile *β* (95% CI)**	**90^{th} quantile *β* (95% CI)**
MNA-SF score	**-0.405 (-0.584 to -0.226) ***	**-0.366 (-.575 to -.156) ***	**-0.381 (-.601 to -.161) ***	**-0.474 (-.691 to -.257) ***	**-0.518 (-0.815 to -0.221) ***	-0.170 (-0.428 to 0.087)
BMI	**0.134 (0.029 to 0.238) ***	**0.132 (.010 to .254) ***	0.092 (-.036 to .220)	**0.159 (.032 to .286) ***	0.119 (-0.053 to 0.293)	-0.005 (-0.155 to 0.145)
Age	-0.002 (-.057 to .051)	-0.002 (-.065 to .0608)	-0.0002 (-.066 to .066)	-0.005 (-.07 to .06)	-0.026 (-0.115 to 0.063)	-0.023 (-0.101 to 0.054)
Sex						
Female	-0.242 (-.865 to 1.35)	-0.256 (-1.55 to 1.04)	0.298 (-1.06 to 1.66)	0.042 (-1.30 to 1.38)	0.163 (-1.67 to 2.00)	0.616 (-0.981 to 2.214)
Male	ref.	----	----	----	----	----
Education level						
No formal education	-0.126 (-1.11 to .859)	0.023 (-1.13 to 1.17)	-0.042 (-1.25 to 1.17)	0.379 (-0.817 to 1.57)	0.466 (-1.17 to 2.10)	-0.005 (-1.42 to 1.41)
Primary or below	-0.188 (-1.27 to .897)	0.305 (-.965 to 1.57)	-0.214 (-1.54 to 1.12)	-0.134 (-1.45 to 1.18)	0.158 (-1.64 to 1.95)	0.091 (-1.47 to 1.65)
Secondary or above	ref.	----	----	----	----	----
Marital status						

Widowed	0.497 (-0.310 to 1.30)	0.058 (-.886 to 1.00)	-0.106 (-1.09 to .88)	0.502 (-0.476 to 1.48)	0.662 (-0.677 to 2.00)	0.518 (-0.646 to 1.68)
Married	ref.	----	----	----	----	----
Residential status						
Sub urban	**2.26 (1.58 to 2.94) ***	**1.09 (.296 to 1.88) ***	**1.01 (.175 to 1.84) ***	**2.28 (1.46 to 3.10) ***	**3.24 (2.11 to 4.37) ***	**4.26 (3.28 to 5.24) ***
Rural	ref.	----				
Employment status						
Employed or business	0.013 (-0.648 to 0.675)	-0.127 (-0.902 to 0.647)	0.23 (-0.582 to 1.04)	-0.087 (-0.889 to .715)	-0.062 (-1.16 to 1.03)	0.399 (-0.555 to 1.35)
Unemployed or retired (ref.)	----	----	----	----	----	----
Smoking habit						
Never	-0.550 (-1.50 to .401)	0.495 (-.618 to 1.60)	0.285 (-.88 to 1.45)	-0.765 (-0.889 to 0.715)	-1.14 (-2.72 to .430)	-2.04 (-3.41 to -.673)
Current or former	ref.	----	----	----	----	----
Betel leaf habit						
Never	-0.238 (-1.35 to .877)	0.281 (-1.02 to 1.58)	-0.29 (-1.66 to 1.08)	0.433 (-0.919 to 1.78)	-0.061 (-1.91 to 1.78)	-0.749 (-2.35 to 0.859)
Current or former	ref.	----	----	----	----	----
Tobacco habit						
Never	-0.179 (-1.22 to .869)	-0.419 (-1.64 to .807)	0.038 (-1.25 to 1.32)	-0.378 (-1.65 to .892)	-0.520 (-2.26 to 1.21)	-0.483 (-1.99 to 1.02)
Current or former	ref.	----	----	----	----	----
Tea or coffee habit						
Never	-0.134 (-1.00 to .733)	0.034 (-0.981 to 1.04)	-0.656 (-1.72 to .409)	0.040 (-1.01 to 1.09)	0.146 (-1.29 to 1.58)	0.276 (-0.974 to 1.52)
Current or former	ref.	----	----	----	----	

Poly-pharmacy (Number of medicines)	**0.210 (.024 to .396) ***	0.064 (-0.153 to .282)	0.010 (-0.218 to .239)	0.205 (-.0205 to .430)	**0.496 (0.187 to 0.805) ***	**0.608 (0.339 to 0.876) ***
LPA (hours)	**-0.196 (-.346 to -.046) ***	0.041 (-0.133 to 0.217)	-0.05 (-0.234 to 0.133)	-0.175 (-0.357 to .006)	-0.417 (-0.665 to -0.168) *	**-0.549 (-0.765 to -0.333) ***
VPA (hours)	-0.037 (-.222 to .147)	-0.003 (-0.220 to 0.213)	-0.105 (-.332 to 0.122)	-0.173 (-0.398 to 0.051)	-0.020 (-0.328 to 0.286)	**0.303 (0.036 to 0.570) ***
DDS score	-0.157 (-.364 to .050)	-0.078 (-0.321 to 0.164)	-0.112 (-.367 to 0.142)	-0.20 (-0.452 to 0.05)	-0.188 (-0.532 to .155)	**-0.030 (-0.329 to 0.268) ***
Chronic health problem						
Yes	0.528 (-.310 to 1.36)	0.741 (-0.241 to 1.72)	0.099 (-.932 to 1.13)	0.597 (-0.420 to 1.61)	0.563 (-0.829 to 1.95)	0.781 (-0.428 to 1.99)
No	ref.	----	----	----	----	----

Table 3: Association between sleep quality and nutritional status

	OR (95% CI)	**(AOR 95% CI)**	**(AOR 95% CI)**
	Model [a]	**Model [b]**	**Model [c]**
Malnutrition	3.91 (1.97 - 7.75) ***	4.36 (2.12 - 8.97) ***	3.75 (1.77 - 7.95) ***
At risk of malnutrition	2.12 (1.10 - 4.08) *	2.61 (1.31 - 5.20) ***	2.33 (1.14 - 4.76) *
Well-nourished	Ref.	Ref.	Ref.

[OR odd ratio; AOR adjusted odd ratio; CI confidence interval

Model [a]: Univariate model

Model [b]: Multivariable model adjusted for age, sex, marital status, employment status, educational status, residential status, and living status

Model [C]: Multivariable model adjusted for covariates in **Model [b]**, light, and vigorous physical activity, comorbidity status, DDS status, taking medicine or not, time of taking medicine, smoking habit, betel leaf habit, tobacco habit, and tea or coffee habit]

Supplementary Files

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- S.Figure1ThedistributionofPSQIscoresincomparisonwithMNASFscores..docx
- S.Figure2AscatterplotPSQIscoresvs.MNASFscores..docx
- S.Table1ComparativedistributionofthePSQIscoreanditsdomainswiththelevelofnutritionalstatus..docx