Indonesian Nursing Journal, 2 (2), 2025 87-94
ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

www.ejournal.polsub.ac.id/index.php/inj

**Indonesian Nursing Journal**

Published by Program Studi Keperawatan Politeknik Negeri Subang

Original research

# Nighttime banana consumption: A natural remedy for better sleep and blood pressure control in hypertensive patients

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**ARTICLE INFO**

Konsumsi pisang di malam hari: Obat alami untuk tidur lebih nyenyak dan mengontrol tekanan darah pada pasien hipertensi

**Keywords:**
banana consumption;
blood pressure,
hypertension;
randomized controlled trial;
sleep quality

**Article history:**
Received 11 November 2024
Revised 22 January 2025
Accepted 28 January 2025



**ABSTRACT**

**Background:** Hypertension is a significant global health concern, often linked with poor sleep quality, both of which contribute to increased cardiovascular risks. Dietary interventions rich in potassium, magnesium, and tryptophan have shown potential in improving blood pressure and sleep quality. However, the specific effects of nighttime banana consumption on these outcomes remain underexplored.

**Purpose:** This study aims to investigate the impact of consuming bananas at night on blood pressure levels and sleep quality among hypertensive patients in the Health Community Kuantan, Malaysia.

**Methods:** A randomized controlled trial was conducted with 120 hypertensive patients aged 30–65 years. Participants were randomized into two groups: the intervention group consumed one medium-sized banana (approximately 120 grams) one hour before bedtime daily for eight weeks, while the control group followed their usual diet. Blood pressure was measured weekly using an automated sphygmomanometer, and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Statistical analyses, including paired t-tests and repeated-measures ANOVA, were performed to evaluate within- and between-group differences.

**Results:** The intervention group demonstrated significant reductions in systolic (mean: 10.3 mmHg, $p < 0.001$) and diastolic (mean: 6.3 mmHg, $p < 0.001$) blood pressure compared to the control group. PSQI scores also improved significantly in the intervention group, with a mean reduction of 3.1 points ($p < 0.001$) from baseline, indicating enhanced sleep quality. The control group showed minimal changes in both parameters.

**Conclusion**: Nighttime banana consumption is an effective, natural, and affordable intervention for improving blood pressure and sleep quality in hypertensive patients. These findings highlight the potential of whole-food dietary strategies as complementary therapies for managing hypertension and its associated conditions.



## 1. Background

Hypertension, or high blood pressure, is a leading cause of cardiovascular diseases such as heart attacks, strokes, and chronic kidney disease, affecting over 1.28 billion adults worldwide. It is particularly concerning in low- and middle-income countries, where healthcare access and lifestyle factors contribute to its prevalence. Despite advancements in pharmacological treatments, the management of hypertension often necessitates complementary non-pharmacological strategies, including dietary and lifestyle modifications [1]–[3].

The role of diet in hypertension management has been well-documented. Nutritional approaches, such as the Dietary Approaches to Stop

ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

Hypertension (DASH) diet, emphasize the consumption of potassium-rich foods, reduced sodium intake, and balanced macronutrients. Potassium, a critical mineral, counteracts the effects of sodium, helps relax blood vessel walls, and reduces tension in the cardiovascular system. Magnesium further supports vascular health by promoting vasodilation and improving endothelial function. These nutrients are abundantly found in bananas, making them a convenient and accessible food choice for individuals at risk of or managing hypertension[4]–[6].

Sleep quality is another crucial but often overlooked factor in hypertension management. Poor sleep, characterized by short duration, fragmented patterns, or sleep disorders like insomnia, is strongly associated with increased blood pressure and heightened cardiovascular risk. Sleep disturbances trigger sympathetic nervous system activation and hormonal dysregulation, both of which contribute to elevated blood pressure. Consequently, improving sleep quality is essential for holistic hypertension management[4], [7]–[9].

Bananas possess bioactive compounds, including tryptophan, an essential amino acid that serves as a precursor to serotonin and melatonin. Serotonin regulates mood and promotes relaxation, while melatonin governs the sleep-wake cycle. The consumption of bananas may facilitate the production of these neurotransmitters, thereby enhancing sleep quality. Despite this theoretical link, few studies have examined the direct impact of bananas on sleep outcomes in clinical settings, particularly among hypertensive individuals[10]–[12].

The potential synergistic effects of bananas on blood pressure and sleep make them an intriguing focus for dietary interventions. Nighttime consumption, in particular, aligns with the body's natural circadian rhythms, potentially enhancing their efficacy. However, cultural and contextual factors, such as dietary habits and accessibility, influence the feasibility and effectiveness of such interventions. In Malaysia, where hypertension prevalence is steadily increasing, exploring culturally relevant and cost-effective solutions is paramount[10], [13]–[15].

Previous studies have highlighted that the timing of food consumption—a concept known as chrononutrition—can significantly influence metabolic and physiological processes. Nighttime consumption of potassium-rich foods, such as bananas, may align with the body's natural circadian rhythms, enhancing their efficacy in lowering nocturnal blood pressure and improving sleep quality. However, existing studies predominantly focus on general dietary patterns or isolated nutrient supplementation, leaving a gap in understanding the holistic impact of whole-food interventions consumed at specific times [16], [17].

This study addresses this gap by investigating the dual effects of nighttime banana consumption on blood pressure and sleep quality among hypertensive patients in the Health Community Kuantan, Malaysia. By focusing on a culturally relevant and cost-effective intervention, this research aims to provide practical insights for dietary guidelines and public health strategies, particularly in regions where hypertension prevalence continues to rise. The findings have the potential to advance our understanding of dietary and lifestyle interventions, emphasizing simplicity and accessibility in managing chronic diseases like hypertension [2], [11].

The Health Community Kuantan, Malaysia, provides an ideal setting for this study due to its diverse population and growing burden of hypertension. Community-based interventions have the potential to address local health challenges while fostering a sense of collective responsibility and participation. The integration of cultural dietary practices with evidence-based recommendations enhances the acceptability and sustainability of interventions. This study aims to fill this gap by evaluating the dual benefits of nighttime banana consumption in hypertensive patients.

## 2. Methods

The methods follow the following structure:

### 2.1 Research design

This study utilized a randomized controlled trial (RCT) design to evaluate the effects of nighttime banana consumption on blood pressure and sleep quality among hypertensive patients. The trial spanned eight weeks, employing a parallel-group design with equal allocation to intervention and control groups. The RCT design ensured the robustness and validity of the findings by minimizing bias and confounding factors.

### 2.2 Setting and sample

The study was conducted at the Health Community Kuantan, Malaysia, which serves a diverse population with varying socio-economic backgrounds. Participants were recruited through community health campaigns and outreach

 

ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

programs. Eligibility Criteria: Inclusion criteria: Diagnosed hypertension based on clinical guidelines, age between 30 and 65 years, no severe cardiovascular or sleep disorders. Exclusion criteria: Participation in specific dietary regimens, and use of sleep-enhancing supplements. To achieve adequate statistical power, 120 participants were enrolled and randomized into intervention and control groups, with 60 participants in each group. Randomization was conducted using a computer-generated sequence to ensure allocation concealment.

### 2.3 Interventions

Participants in the intervention group consumed one medium-sized banana (approximately 120 grams) one hour before bedtime daily for eight weeks. Bananas were standardized for size and ripeness to ensure consistency. The control group continued their usual diets without specific dietary additions. Both groups were instructed to maintain their typical levels of physical activity and medication regimens. Weekly follow-up visits were scheduled to: Monitor adherence to the intervention, address any participant concerns or challenges. Adherence was tracked using self-reported daily logs, which were reviewed during follow-up visits. Participants were also reminded via phone or text messages to enhance compliance.

### 2.4 Instruments and data collection

Primary outcomes included changes in blood pressure (systolic and diastolic) and sleep quality. Blood pressure was measured weekly using an automated sphygmomanometer calibrated to international standards. Each measurement was taken twice, one minute apart, and the mean value was recorded. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a validated tool measuring multiple dimensions of sleep, including latency, duration, and disturbances. PSQI scores were collected at baseline and at weekly intervals.

Baseline demographic data, including age, gender, BMI, and socio-economic status, were collected at enrollment. Adherence to the intervention was monitored through self-reported logs and confirmed during weekly follow-ups. Participants were queried about potential adverse effects, and any reported events were documented and addressed promptly. Blinded research assistants collected data to minimize bias during measurement.

### 2.5 Data analysis

Data analysis was performed using SPSS (version 26.0) to ensure reproducibility and transparency. Statistical methods included: Paired t-tests to compare pre- and post-intervention values within groups. Repeated-measures ANOVA were employed to compare baseline and post-intervention blood pressure readings and PSQI scores within and between groups. Correlation analyses to explore relationships between changes in blood pressure and sleep quality. Significance was set at a p-value $< 0.05$ for all statistical tests.

### 2.6 Research ethics

Approval was obtained from the relevant institutional ethics review board, and all participants provided written informed consent before enrollment. Participants were assured of the confidentiality of their data and had the right to withdraw from the study at any time without consequences. Adverse events, if any, were monitored and addressed promptly to ensure participant safety. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

## 3. Results

The results of this study revealed significant findings regarding the impact of nighttime banana consumption on blood pressure and sleep quality among hypertensive patients. Baseline demographic data showed a well-balanced distribution of participants in terms of age, gender, and socio-economic status between the intervention and control groups. Blood pressure and sleep quality improved substantially in the intervention group compared to the control group, as demonstrated by both descriptive and inferential statistical analyses.

**Table 1. Demographic Characteristics of Respondents (n = 120)**

| Characteristic | Intervention Group (n=60) | Control Group (n=60) | Total (N=120) |
|---|---|---|---|
| Mean Age (years) | 52.3 ± 6.4 | 53.1 ± 7.2 | 52.7 ± 6.8 |
| Gender (Male/Female) | 28/32 | 30/30 | 58/62 |
| BMI (kg/m²) | 27.5 ± 3.8 | 27.9 ± 4.1 | 27.7 ± 4.0 |
| Socio-Economic Status | | | |
| Low (%) | 40 | 42 | 41 |

 

ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

| | | | |
|---|---|---|---|
| Middle (%) | 45 | 43 | 44 |
| High (%) | 15 | 15 | 15 |

The demographic data indicate that participants in both groups were comparable in age, gender distribution, and body mass index, ensuring that these variables did not confound the results. Socio-economic status was also evenly distributed, reflecting the diversity of the study population.

**Table 2. Blood Pressure and Sleep Quality Variables**

| Variable | Baseline Mean (SD) | Post-Intervention Mean (SD) | Mean Difference (95% CI) | p-value |
|---|---|---|---|---|
| Systolic BP (mmHg) | 140.5 (10.2) | 130.2 (8.7) | -10.3 (-12.4, -8.2) | <0.001 |
| Diastolic BP (mmHg) | 88.6 (6.4) | 82.3 (5.8) | -6.3 (-7.5, -5.1) | <0.001 |
| PSQI Score (Total) | 10.2 (3.1) | 7.1 (2.5) | (-3.8, -2.4) | <0.001 |

The analysis of key variables revealed substantial improvements in the intervention group. For systolic blood pressure (SBP), the mean baseline value was 140.5 mmHg, which decreased to 130.2 mmHg post-intervention, with a mean reduction of 10.3 mmHg. Diastolic blood pressure (DBP) also showed significant improvement, dropping from a baseline mean of 88.6 mmHg to 82.3 mmHg, a mean reduction of 6.3 mmHg. These reductions were statistically significant, with p-values less than 0.001.

In terms of sleep quality, the Pittsburgh Sleep Quality Index (PSQI) scores decreased from a baseline mean of 10.2 to 7.1, indicating notable improvements in sleep quality. The mean difference of -3.1 points highlights a significant enhancement, further confirmed by a p-value of <0.001.

**Table 3. Paired T-Test Analysis of Intervention and Control Groups**

| Variable | Group | Mean Difference (95% CI) | p-value |
|---|---|---|---|
| Systolic BP (mmHg) | Intervention | -10.3 (-12.4, -8.2) | <0.001 |
| | Control | -2.1 (-3.5, -0.7) | 0.004 |
| Diastolic BP (mmHg) | Intervention | -6.3 (-7.5, -5.1) | <0.001 |
| | Control | -1.5 (-2.4, -0.6) | 0.006 |
| PSQI Score | Intervention | -3.1 (-3.8, -2.4) | <0.001 |
| | Control | -0.7 (-1.2, -0.2) | 0.011 |

The paired t-test results reinforced the observed improvements. In the intervention group, reductions in SBP and DBP were significantly larger compared to the control group, with mean differences of -10.3 mmHg and -6.3 mmHg, respectively. The PSQI scores also demonstrated a substantial decline in the intervention group compared to the control, with a mean difference of -3.1 points. These findings confirm the effectiveness of nighttime banana consumption in improving both blood pressure and sleep quality.

**Table 4. ANOVA Results for Intervention Effects**

| Variable | Source | F-value | p-value |
|---|---|---|---|
| Systolic BP (mmHg) | Group | 24.67 | <0.001 |
| | Time | 18.54 | <0.001 |
| | Interaction | 12.12 | <0.001 |
| Diastolic BP (mmHg) | Group | 20.32 | <0.001 |
| | Time | 16.89 | <0.001 |
| | Interaction | 10.45 | <0.001 |
| PSQI Score | Group | 22.78 | <0.001 |
| | Time | 19.63 | <0.001 |
| | Interaction | 14.21 | <0.001 |

 

ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

The ANOVA results provide further support for the intervention's efficacy. Significant group effects were observed for all variables, indicating differences between the intervention and control groups. Time effects were also significant, reflecting changes over the study period. The interaction effects suggest that the improvements in blood pressure and sleep quality were more pronounced in the intervention group compared to the control group, highlighting the synergistic impact of nighttime banana consumption.

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## 4. Discussion

The findings of this study reveal significant improvements in both blood pressure and sleep quality among hypertensive patients who consumed bananas at night for eight weeks. These results align with previous research on the cardiovascular and sleep-enhancing benefits of potassium, magnesium, and tryptophan-rich foods. This discussion explores the implications of these findings within the broader context of dietary and lifestyle interventions for hypertension management, emphasizing potential mechanisms, comparative effectiveness, and practical applications[17], [18].

The reduction in both systolic (10.3 mmHg) and diastolic (6.3 mmHg) blood pressure in the intervention group underscores the efficacy of bananas as an adjunct dietary intervention. Potassium, a primary nutrient in bananas, plays a crucial role in counteracting the hypertensive effects of sodium and promoting vasodilation. Potassium achieves this by modulating sodium excretion via the kidneys and relaxing vascular smooth muscle cells[19]. The observed reductions are consistent with the DASH (Dietary Approaches to Stop Hypertension) diet principles, which advocate for increased consumption of potassium-rich fruits and vegetables[6].

Magnesium, another essential nutrient in bananas, supports blood pressure regulation by enhancing endothelial function and reducing vascular resistance. Magnesium also acts as a natural calcium channel blocker, preventing excessive calcium influx into arterial walls, which is a common contributor to increased vascular tone[20]. The combined effects of potassium and magnesium in bananas likely contributed to the substantial reductions in blood pressure observed in this study.

Notably, the timing of banana consumption may have amplified these effects. Nighttime consumption aligns with the body's circadian rhythms, potentially enhancing the bioavailability and efficacy of these nutrients. Studies on chrononutrition suggest that evening intake of potassium may be more effective in lowering nocturnal blood pressure, a critical factor in reducing cardiovascular risk [21]. This underscores the importance of not only what we eat but also when we eat.

The significant reduction in PSQI scores highlights the role of bananas in improving sleep quality. Tryptophan, an essential amino acid found in bananas, serves as a precursor for serotonin and melatonin, neurotransmitters critical for regulating mood and the sleep-wake cycle. Serotonin promotes relaxation and reduces anxiety, while melatonin facilitates the onset and maintenance of sleep by signaling the brain to enter a restful state [10], [22]

The findings corroborate previous research indicating that tryptophan intake from food sources can improve sleep quality and duration. Unlike isolated supplements, whole foods like bananas offer a synergistic matrix of nutrients that may enhance tryptophan metabolism and bioavailability. For example, magnesium and vitamin B6, both present in bananas, are cofactors in the enzymatic pathways that convert tryptophan to serotonin and melatonin [15], [23], [24].

Improved sleep quality has cascading benefits for hypertension management. Sleep disturbances are associated with increased sympathetic nervous system activity and heightened cortisol levels, both of which contribute to elevated blood pressure[25]. By enhancing sleep quality, bananas may indirectly mitigate these pathways, creating a positive feedback loop that further supports cardiovascular health[10].

While the control group also experienced minor improvements in blood pressure and sleep quality, the magnitude of change was significantly smaller than in the intervention group. This suggests that the observed effects in the intervention group are unlikely to be solely attributable to factors such as lifestyle changes or placebo effects. The controlled study design, including the provision of uniform bananas and regular follow-ups, strengthens the causal inference between banana consumption and the observed outcomes.

ISSN 2988-7623 (Online)
ISSN 2988-7577 (Print)

The synergistic interplay between potassium, magnesium, and tryptophan in bananas offers a plausible explanation for the dual benefits observed. Potassium and magnesium primarily target vascular health, while tryptophan and its derivatives influence neurophysiological pathways related to sleep. This dual mechanism highlights the potential of bananas as a holistic intervention for hypertensive patients, addressing both the physiological and behavioral dimensions of hypertension[16]–[18]. Emerging research also suggests that the fiber content in bananas may contribute to their benefits. Dietary fiber influences gut microbiota composition, promoting the production of short-chain fatty acids (SCFAs) that have anti-inflammatory and blood-pressure-lowering effects [26]. The gut-brain axis further connects these effects to sleep regulation, as SCFAs can modulate the production of sleep-related neurotransmitters[7].

The affordability and accessibility of bananas make them an attractive option for large-scale public health interventions, particularly in resource-limited settings. Unlike pharmacological treatments, which may be associated with side effects and high costs, dietary interventions offer a natural and sustainable alternative. Bananas, as a widely available fruit, can be easily integrated into existing dietary patterns, enhancing their acceptability and feasibility[27], [28]. Community-based programs could leverage these findings to promote banana consumption among hypertensive patients. Educational campaigns emphasizing the benefits of nighttime consumption could amplify the impact of such interventions[5]. Moreover, the integration of bananas into hospital and clinic dietary plans for hypertensive patients could provide immediate benefits, especially for those already at high cardiovascular risk.

While this study provides compelling evidence for the benefits of nighttime banana consumption, several limitations warrant consideration. First, the study's duration was relatively short (eight weeks), which limits the assessment of long-term effects. Future research could explore whether the observed benefits are sustained over months or years and whether they translate into reduced cardiovascular events. Second, the study relied on self-reported sleep quality data, which, while validated, may be subject to reporting bias. Incorporating objective measures such as actigraphy or polysomnography in future studies could provide more robust insights into sleep outcomes. Third, the study population was limited to a single community in Malaysia, which may limit the generalizability of the findings. Replicating this study in diverse populations with varying dietary patterns and cultural practices would enhance its external validity. Lastly, while the findings suggest a synergistic effect of the nutrients in bananas, the exact mechanisms remain speculative. Advanced biochemical analyses and mechanistic studies could elucidate how these nutrients interact at the molecular level to influence blood pressure and sleep.

## 5. Conclusion

This study demonstrates that nighttime banana consumption significantly improves blood pressure and sleep quality among hypertensive patients. By leveraging the synergistic effects of potassium, magnesium, and tryptophan, bananas offer a natural and accessible intervention that addresses both physiological and behavioral dimensions of hypertension management. These findings have important implications for dietary guidelines, public health strategies, and clinical practice, emphasizing the potential of whole-food approaches in managing chronic diseases.

As global hypertension rates continue to rise, integrating cost-effective and culturally relevant dietary interventions like banana consumption into existing healthcare frameworks could reduce the burden of cardiovascular disease. Future research should build on these findings to explore long-term effects, optimize intervention protocols, and expand the applicability of this promising strategy.

## 6. Acknowledgment

We extend our deepest gratitude to the Health Community Kuantan, Malaysia, for their invaluable support and collaboration throughout this study. Their provision of resources and logistical assistance played a critical role in ensuring the successful implementation of this research.

We are also profoundly grateful to the participants of this study for their willingness, time, and commitment. Your participation and dedication to the process have significantly contributed to advancing our understanding of the relationship between dietary interventions and hypertension management. Finally, we acknowledge the contributions of the research team and healthcare professionals who supported the recruitment, data collection, and analysis phases of

 

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this study. Your collective efforts and dedication to excellence have made this research possible.

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