Journal of Health and Therapy, 3(2), 2024, 1-9
Available at: https://journal.nurscienceinstitute.id/index.php/jht
EISSN: 2808-7747

Exploring the link between coffee consumption and hypertension risk

Umar Abdul Hamid, Kemal Akbar Suryoadji*

Faculty of Medicine, Universitas Indonesia, Indonesia

*) Corresponding Author (e-mail: kemalakbar11@gmail.com)

Abstract

The relationship between coffee consumption and hypertension remains controversial, with studies reporting neutral, harmful, or protective effects. Understanding this association is particularly relevant in Indonesia, where coffee consumption is culturally prevalent, and hypertension is a leading public health concern. A 58-year-old male presented for a routine health examination and was found to have Stage 1–2 hypertension (168/83 mmHg), despite being asymptomatic with no risk factors. His daily intake included two cups of coffee. Despite initial lifestyle modifications, including sodium restriction, his blood pressure remained elevated, necessitating pharmacological therapy. A structured literature search was conducted using PubMed, ScienceDirect, and Cochrane Library databases. Two systematic reviews and meta-analyses were performed using the defined PICO criteria and the PRISMA methodology. One review reported no significant association between caffeine intake and hypertension (RR: 0.97, 95% CI: 0.90–1.05), while another found a modest inverse relationship at higher coffee consumption levels (RR: 0.97, 95% CI: 0.94–0.99). Moderate habitual coffee consumption does not appear to increase hypertension risk and may have protective cardiovascular effects.

Keywords: Caffeine, Cardiovascular Risk, Coffee, Hypertension

Abstrak

Hubungan antara konsumsi kopi dan hipertensi masih menjadi perdebatan, dengan berbagai studi yang melaporkan efek netral, merugikan, maupun protektif. Pemahaman mengenai hubungan ini sangat relevan di Indonesia, di mana konsumsi kopi merupakan bagian dari budaya, sementara hipertensi tetap menjadi masalah kesehatan masyarakat yang utama. Seorang pria berusia 58 tahun datang untuk pemeriksaan kesehatan rutin dan ditemukan mengalami hipertensi derajat 1–2 (168/83 mmHg), meskipun tanpa gejala dan tanpa faktor risiko. Asupan hariannya meliputi dua cangkir kopi. Meskipun telah dilakukan modifikasi gaya hidup awal, termasuk pembatasan natrium, tekanan darahnya tetap tinggi sehingga memerlukan terapi farmakologis. Pencarian literatur terstruktur dilakukan melalui basis data PubMed, ScienceDirect, dan Cochrane Library. Dua tinjauan sistematis dan meta-analisis dilakukan menggunakan kriteria PICO dan metodologi PRISMA yang telah ditetapkan. Salah satu tinjauan melaporkan tidak terdapat hubungan yang signifikan antara asupan kafein dan hipertensi (RR: 0,97; 95% CI: 0,90–1,05), sedangkan tinjauan lainnya menemukan hubungan terbalik yang kecil pada tingkat konsumsi kopi yang lebih tinggi (RR: 0,97; 95% CI: 0,94–0,99). Konsumsi kopi dalam jumlah sedang secara habitual tampaknya tidak meningkatkan risiko hipertensi dan bahkan dapat memberikan efek protektif terhadap sistem kardiovaskular.

Kata kunci: Hipertensi, Kafein, Kopi, Risiko Kardiovaskular

How to cite: Hamid, U. A., & Suryoadji, K. A. (2024). Exploring the link between coffee consumption and hypertension risk. *Journal of Health and Therapy*, *3*(2), 1–9. https://doi.org/10.53088/jht.v3i2.2370

1. Introduction

Coffee is one of the most widely consumed beverages globally, playing a prominent role in social, cultural, and economic contexts. In many populations, including Indonesia, coffee has become an integral part of daily routines, with both traditional and modern consumption practices increasingly prevalent across all age groups (Arreia et al, 2023). While coffee is often appreciated for its stimulating effects and potential health benefits, such as improved cognitive performance and antioxidant properties, its long-term impact on cardiovascular health, particularly blood pressure regulation, remains a topic of ongoing scientific debate (Mendoza et al, 2023).

Hypertension is defined as an office systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg (World Health Organization, 2021). It is a major global health concern and a leading risk factor for cardiovascular disease (CVD), stroke, and kidney failure. In Indonesia, recent data indicate that approximately 34.1% of adults suffer from hypertension, posing a significant public health challenge, hence an early treatment initiation is warranted (WHO, 2023).

As lifestyle and dietary habits are closely linked to the development and progression of hypertension, understanding modifiable factors such as coffee consumption is essential for informing public health strategies and clinical recommendations (Turana et al, 2020).The relationship between coffee intake and blood pressure is complex and influenced by multiple variables, including the amount and frequency of consumption, individual sensitivity to caffeine, genetic predispositions, and the presence of other comorbid conditions. Although some studies have suggested that moderate coffee intake may be neutral or even protective against hypertension, others report an association between high coffee consumption and elevated blood pressure, especially among individuals with existing risk factors (Surma et al, 2021; Borghic et al, 2022).

Given these conflicting findings, further investigation is warranted to clarify the potential role of coffee in the etiology and management of hypertension. This case report aims to explore the association between habitual coffee consumption and the risk of developing hypertension, contributing to a more nuanced understanding of its implications for cardiovascular disease prevention, particularly in the Indonesian context.

Case Illustration

A 58-year-old male presented to our hospital for routine annual health examination. His chief complaints included symptoms of gingival inflammation, for which he was seeking dental evaluation. Incidentally, his blood pressure increased to 168/83 mmHg. He was otherwise asymptomatic, with no reports of headache, dizziness, visual disturbances, or chest discomfort. On examination, his vital signs were within normal limits aside from the elevated blood pressure. The patient had a body mass index (BMI) within the normal range and no clinical signs of secondary hypertension. His medical history was unremarkable, with no prior diagnosis of cardiovascular disease, diabetes mellitus, or renal impairment.

Lifestyle assessment revealed that the patient engaged in regular low-intensity physical activity, exercising approximately 3 to 5 times per week. He reported no history of tobacco or alcohol use. Notably, he reported a consistent daily intake of two cups of coffee. Dietary habits were otherwise balanced, though specific data on sodium intake were unavailable. The patient was advised on non-pharmacological lifestyle modifications, including dietary improvements, particularly sodium restriction, and maintenance of regular physical activity. However, his coffee consumption remained unchanged.

At a follow-up evaluation two weeks later, his blood pressure remained elevated at 158/76 mmHg, indicating persistent Stage 1–2 hypertension despite initial lifestyle guidance. Given the lack of sufficient blood pressure reduction, the decision was made to initiate pharmacological management. He was prescribed a combination of Amlodipine 5 mg and Ramipril 5 mg, both administered once daily.

2. Research Method

This evidence-based case report was conducted following a systematic and structured approach to identify and evaluate the best available evidence on the association between coffee consumption and the risk of developing hypertension. A comprehensive literature search was performed across three major scientific databases: PubMed, ScienceDirect, and the Cochrane Library. The search strategy employed Medical Subject Headings (MeSH) and Boolean operators to ensure broad yet targeted retrieval of relevant literature. The key terms used were: “Coffee Consumption” AND “Hypertension” AND “Risk” AND “Blood Pressure.” Filters were applied to limit the search to studies involving human subjects and publications in English within the past five years to ensure the timeliness and relevance of the evidence.

Eligibility criteria were determined based on the PICO (Population, Intervention/Exposure, Comparison, Outcome) framework:

Table 1. Eligibility Criteria

Population	Intervention/Exposure	Comparison	Outcome
Adult individuals from the general population	Regular coffee or caffeine consumption	Individuals with low or no coffee consumption	Incidence or risk of developing hypertension or changes in blood pressure values.

Additional inclusion criteria included cohort studies, systematic reviews/meta-analyses, studies involving human participants, and full-text availability. Exclusion criterias were studies lacking full-text access, animal studies, editorials, and non-peer-reviewed literature were excluded.

The study selection process adhered to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. After an initial yield of 2,073 articles (319 from PubMed, 1,604 from ScienceDirect, and 150 from Cochrane), title and abstract screening narrowed the selection to two potentially relevant articles.

Duplicate records were removed. After full-text assessment based on the inclusion and exclusion criteria, two high-quality articles were deemed suitable for inclusion in this evidence-based case report. The full selection process is depicted in Figure 1. The final articles were critically appraised using standardized tools from the Centre for Evidence-Based Medicine (CEBM) to assess methodological rigor, relevance, and applicability to clinical practice.

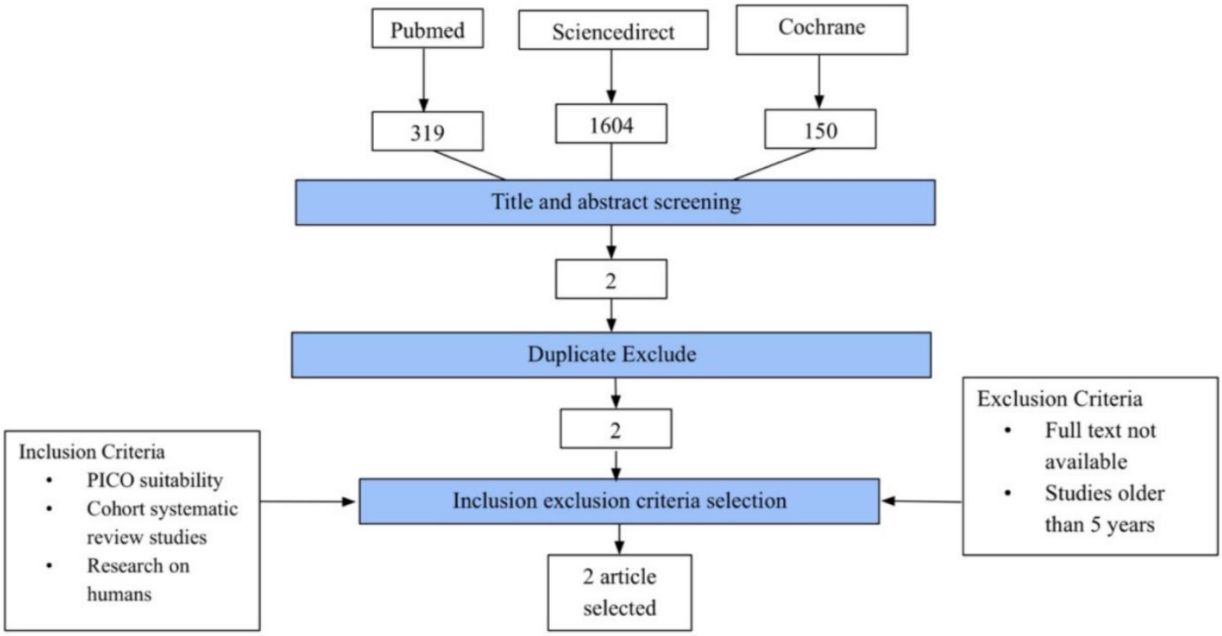

Figure 1. Article search and selection

3. Results and Discussion

3.1. Results

We identified two systematic reviews and meta-analyses that met the inclusion criteria, both evaluating the relationship between coffee consumption and hypertension among adults over 18 and older. The first study, conducted by Han M et al. (2022), synthesized data from multiple cohort studies and concluded that caffeine consumption was not significantly associated with an increased risk of hypertension. The pooled analysis yielded a relative risk (RR) of 0.97 with a 95% confidence interval (CI) of 0.90–1.05, indicating a statistically nonsignificant effect (Han et al, 2022). In contrast, the second study by D'Elia et al. (2019) conducted a dose-response meta-analysis of prospective studies and found that coffee consumption at higher doses (>2 cups/day) was associated with a protective effect against the incidence of hypertension, with a pooled RR of 0.97 and a 95% CI of 0.94–0.99, suggesting a modest but statistically significant reduction in risk (D'Elia et al, 2019).

Both studies were assessed using the Centre for Evidence-Based Medicine (CEBM) critical appraisal tool (Oxford, 2010). Each demonstrated good methodological quality, included PICO elements, and clearly reported their findings, heterogeneity, and summary data. While neither study explicitly included a formal critical appraisal within

their own text, their results were deemed valid, important, and applicable to the current clinical context. These findings contribute valuable insights into the ongoing debate regarding the cardiovascular implications of habitual coffee consumption. A detailed evaluation of the validity, importance, and applicability of both studies is summarized in Table 2.

Table 2. Critical Appraisal of Systematic Reviews and Meta-Analysis.

Criteria	Han M et al. (2022)	D'Elia et al. (2019)
	Research	
Population	314,827 participants (64,650 hypertensive cases)	196,256 participants (41,184 hypertensive cases)
Intervention	Coffee vs non-coffee drinker	High dose (>2 cups/day) coffee vs non-coffee drinker
Outcome	Risk of hypertension development	Incidence of hypertension
	Validity	
Inclusion of PICO	+	+
Clear inclusion and exclusion criteria	+	+
Use of relevant references	+	+
Inclusion of critical appraisal in the study	-	-
Inclusion of high-quality studies only	+	+
Summary of results in table and plot	+	+
Explanation of result similarity and heterogeneity	+	+
Conclusion (Validity)	Valid	Valid
	Importance	
Prognostic estimate (likelihood over time)	RR = 0.97	RR = 0.97
Confidence Interval	[0.90–1.05]	[0.94–0.99]
Conclusion (Importance)	Important	Important
	Applicability	
Similarity of study patients	+	+
Clinical relevance of the evidence	+	+
Conclusion (Applicability)	Applicable	Applicable

Note: + clearly mentioned, - not mentioned, ? unclearly mentioned.

3.2. Discussion

This case illustrates the case of a 58-year-old male who was incidentally diagnosed with stage 1–2 hypertension during a routine health check. He had no history of cardiovascular disease, diabetes, or renal impairment. His lifestyle was generally healthy, with regular physical activity, a normal BMI, and no tobacco or alcohol use. His dietary intake was balanced, though sodium levels were not measured. Notably, he reported consistent daily coffee consumption (two cups/day). Despite initial lifestyle advice, including sodium restriction, his blood pressure remained elevated, prompting

pharmacological intervention. This scenario raises the question of whether coffee consumption played a role in the development or persistence of hypertension.

Two high-quality systematic reviews were identified. Han et al. (2022) reported no significant association between caffeine consumption and hypertension risk, with a pooled relative risk (RR) of 0.97 (95% CI: 0.90–1.05) (Han et al, 2022). In contrast, D'Elia et al. (2019) found a modest but statistically significant inverse association between coffee consumption and hypertension, particularly at higher intake levels, with an RR of 0.97 (95% CI: 0.94–0.99). Additional reviews suggest this protective effect is more pronounced in cross-sectional studies, where up to a 21% risk reduction has been reported. The variation between studies highlights the complexity of interpreting population-level data on coffee intake and hypertension (D'Elia et al, 2019)

The patient's moderate coffee intake of two cups daily likely falls within the "neutral to beneficial" range identified in the evidence. Given his otherwise low-risk profile, it is unlikely that coffee was a primary contributor to his elevated blood pressure. Additionally, the evidence suggests that the hypertensive effects of acute caffeine exposure do not translate into chronic risk for habitual coffee consumers. This supports the decision to not restrict his coffee intake, focusing instead on comprehensive lifestyle and pharmacologic management (Han et al, 2022; D'Elia et al, 2019).

From a clinical perspective, moderate coffee consumption does not appear to increase the risk of hypertension and may offer cardiovascular protection in some individuals. However, acute caffeine intake can transiently increase blood pressure, and patients should avoid coffee before clinical measurements. For individuals identified as slow caffeine metabolizers, coffee consumption may need to be moderated due to a potential increase in cardiovascular risk (up to 2.8-fold higher in some studies). Thus, individualized assessment remains key, especially in hypertensive patients or those with a family history of cardiovascular disease (Haghighatdoost et al, 2023; Mesas et al, 2011).

Caffeine's impact on blood pressure reflects a complex interplay between acute and chronic physiological responses, genetic metabolism, and vascular effects. Acutely, caffeine acts as an adenosine receptor antagonist, leading to transient vasoconstriction and increases in systolic and diastolic blood pressure, by approximately 8.1 Eligibility criteria mmHg and 5.7 mmHg, respectively (Islam et al, 2023). However, with regular consumption, the body develops tolerance to these pressor effects within days, explaining why habitual coffee intake does not typically result in sustained hypertension. Genetic polymorphisms in the CYP1A2 enzyme, which metabolizes caffeine, further modulate individual responses (De Giuseppe et al, 2019). Slow metabolizers (AC or CC genotypes) exhibit prolonged caffeine exposure, increasing hypertension risk—by as much as 2.8-fold with high intake—whereas fast metabolizers tend to tolerate or even benefit from moderate consumption (Miranda et al, 2021). Smoking, a known inducer of CYP1A2, can also alter caffeine metabolism, complicating risk profiles. On a vascular level, caffeine, in synergy with coffee's polyphenols, enhances endothelial function by improving nitric oxide availability,

although compounds like hydroxylhydroquinone (HHQ) formed during roasting may counteract these benefits. These multifaceted mechanisms underscore why caffeine's cardiovascular effects vary widely between individuals and across populations (Miranda et al, 2021).

The included studies were methodologically sound, yet several limitations persist. Measurement bias is common, as dietary intake is often assessed via food frequency questionnaires or 24-hour recalls, each prone to under- or overestimation. Studies also differ in how they classify coffee consumption, some use absolute cup counts, while others use relative intake percentiles, complicating meta-analytical comparisons. Moreover, neither included study performed formal critical appraisal internally, and follow-up durations in prospective studies were often short, limiting conclusions about long-term cardiovascular effects (Han et al, 2022; D'Elia et al, 2019).

Future studies should focus on population-specific genetic variants (such as CYP1A2 polymorphisms), coffee preparation methods, and long-term cardiovascular outcomes in Southeast Asian populations. There is also a need for improved dietary assessment tools to reduce bias in estimating coffee intake. From a public health standpoint, moderate coffee intake (3–4 cups/day) may be incorporated into lifestyle guidance for the general population, provided that other risk factors are considered. However, excessive intake (>6 cups/day) may not confer additional benefit and could pose harm in genetically susceptible individuals.

4. Conclusion

This evidence-based case report supports the growing consensus that moderate habitual coffee intake does not increase the risk of developing hypertension and may even offer protective cardiovascular effects in certain populations. While acute caffeine intake can transiently raise blood pressure, these effects are generally attenuated with regular consumption due to physiological adaptation. Genetic factors, particularly variations in caffeine metabolism, play a significant role in individual responses and should inform clinical recommendations. In the presented case, the patient's consistent coffee intake likely did not contribute to his persistent hypertension. Therefore, coffee restriction may not be necessary for most individuals with well-controlled lifestyle factors, although personalized assessment remains essential.

References

Arreia, L., Pugliese, G., Frias-Toral, E., El Ghoch, M., Castellucci, B., Chapela, S. P., Carignano, M. L. A., Laudisio, D., Savastano, S., Colao, A., & Muscogiuri, G. (2023). *Coffee consumption, health benefits and side effects: A narrative review and update for dietitians and nutritionists. Critical Reviews in Food Science and Nutrition, 63*(9), 1238–1261. https://doi.org/10.1080/10408398.2021.1963207

Jones, D. W., Ferdinand, K. C., Taler, S. J., Johnson, H. M., Shimbo, D., ... & Williamson, J. D. (2025). 2025 AHA/ACC/AANP/AAPA/ABC/ACCP/ACPM/AGS/AMA/ASPC/NMA/PCNA/SGIM guideline for the prevention, detection, evaluation and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart

Association Joint Committee on Clinical Practice Guidelines. Circulation, 152(11), e11. https://doi.org/10.1161/CIR.0000000000001356

Borghi, C. (2022). *Coffee and blood pressure: Exciting news! Blood Pressure, 31*(1), 284–287. https://doi.org/10.1080/08037051.2022.2136621

Centre for Evidence-Based Medicine, University of Oxford. (2010). *Systematic review appraisal sheet.*https://www.cebm.ox.ac.uk

D'Elia, L., La Fata, E., Galletti, F., Scalfi, L., & Strazzullo, P. (2019). *Coffee consumption and risk of hypertension: A dose–response meta-analysis of prospective studies. European Journal of Nutrition, 58*, 271–280. https://doi.org/10.1007/s00394-017-1591-z

De Giuseppe, R., Di Napoli, I., Granata, F., Mottolese, A., & Cena, H. (2019). *Caffeine and blood pressure: A critical review perspective. Nutrition Research Reviews, 32*(2), 169–175. https://doi.org/10.1017/S0954422419000015

McEvoy, J. W., McCarthy, C. P., Bruno, R. M., Brouwers, S., Canavan, M. D., Ceconi, C., ... & Touyz, R. M. (2024). 2024 ESC Guidelines for the management of elevated blood pressure and hypertension: Developed by the task force on the management of elevated blood pressure and hypertension of the European Society of Cardiology (ESC) and endorsed by the European Society of Endocrinology (ESE) and the European Stroke Organisation (ESO). European heart journal, 45(38), 3912-4018. https://doi.org/10.1093/eurheartj/ehae178

Haghighatdoost, F., Hajihashemi, P., de Sousa Romeiro, A. M., Mohammadifard, N., Sarrafzadegan, N., de Oliveira, C., & Silveira, E. A. (2023). *Coffee consumption and risk of hypertension in adults: Systematic review and meta-analysis.Nutrients, 15*(13), 3060. https://doi.org/10.3390/nu15133060

Han, M., Oh, Y., & Myung, S. K. (2022). *Coffee intake and risk of hypertension: A meta-analysis of cohort studies.Journal of Korean Medical Science, 37*(45), e332. https://doi.org/10.3346/jkms.2022.37.e332

Islam, R., Ahmed, M., Ullah, W., Tahir, Y. B., Gul, S., Hussain, N., Islam, H., & Anjum, M. U. (2023). *Effect of caffeine in hypertension. Current Problems in Cardiology, 48*(11), 101892. https://doi.org/10.1016/j.cpcardiol.2023.101892

Mendoza, M. F., Sulague, R. M., Posas-Mendoza, T., & Lavie, C. J. (2023). *Impact of coffee consumption on cardiovascular health. Ochsner Journal, 23*(2), 152–158. https://doi.org/10.31486/toj.22.0073

Mesas, A. E., Leon-Muñoz, L. M., Rodriguez-Artalejo, F., & Lopez-Garcia, E. (2011). *The effect of coffee on blood pressure and cardiovascular disease in hypertensive individuals: A systematic review and meta-analysis. The American Journal of Clinical Nutrition, 94*(4), 1113–1126. https://doi.org/10.3945/ajcn.111.016667

Miranda, A. M., Goulart, A. C., Benseñor, I. M., Lotufo, P. A., & Marchioni, D. M. (2021). *Coffee consumption and risk of hypertension: A prospective analysis in the cohort study. Clinical Nutrition, 40*(2), 542–549. https://doi.org/10.1016/j.clnu.2020.05.052

Surma, S., & Oparil, S. (2021). *Coffee and arterial hypertension. Current Hypertension Reports, 23*(7), 38. https://doi.org/10.1007/s11906-021-01156-3

Turana, Y., Tengkawan, J., & Soenarta, A. A. (2020). *Asian management of hypertension: Current status, home blood pressure, and specific concerns in Indonesia. Journal of Clinical Hypertension (Greenwich), 22*(3), 483–485. https://doi.org/10.1111/jch.13681

World Health Organization. (2021). Guideline for the pharmacological treatment of hypertension in adults. World Health Organization.

World Health Organization. (2023). *Indonesian hypertension profile.* Geneva, Switzerland.