

Mental stress and fast-food consumption as determinants of early hypertension among students: A Qualitative Study

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ABSTRACT

Introduction: Hypertension is a major global public health problem affecting more than 1.2 billion people worldwide and contributing substantially to cardiovascular morbidity and premature mortality. Recent evidence indicates a rising trend of elevated blood pressure among young adults, particularly in low- and middle-income countries experiencing rapid lifestyle and dietary transitions. University students are increasingly exposed to chronic academic stress and easy access to high-sodium fast food, potentially accelerating early cardiovascular risk. However, limited qualitative evidence integrates psychosocial and dietary determinants of early hypertension within student populations.

Research Methodology: This qualitative study employed a phenomenological approach to explore students lived experiences related to mental stress, fast food consumption, and perceived early hypertension risk. The study was conducted at a public university in Indonesia between March and June 2025. Twenty undergraduate students aged 18–25 years were recruited using purposive maximum variation sampling. Data were collected through in-depth semi-structured interviews and analyzed using thematic analysis following Braun and Clarke's framework. Data saturation was achieved at the 18th interview and confirmed in subsequent interviews.

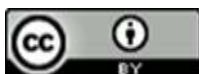
Results: Four major themes emerged: (1) academic and psychosocial stress as persistent pressure; (2) fast food as a stress-driven coping mechanism; (3) limited awareness of early hypertension risk; and (4) the interconnection between stress, diet, and physical symptoms. Participants described chronic stress leading to frequent fast-food consumption, which was perceived to contribute to headaches, palpitations, and fatigue. A knowledge behavior gap was evident, as awareness did not translate into preventive action.

Conclusion: Early hypertension risk among students is shaped by the interaction between psychosocial stress and maladaptive dietary coping behaviors. Integrated campus-based strategies incorporating stress management, healthier food environments, and routine blood pressure screening are essential to prevent long-term cardiovascular disease.

Keywords: Adolescent; Fast Foods; Hypertension; Psychological Stress.



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INTRODUCTION

Hypertension remains one of the most significant public health challenges worldwide and is a leading modifiable risk factor for cardiovascular diseases, stroke, and premature mortality (Abd Al-Alim *et al.*, 2024). Traditionally considered a condition affecting middle-aged and older adults, emerging evidence indicates a concerning rise in elevated blood pressure among adolescents and young adults (Abenavoli *et al.*, 2026). Early-onset hypertension is particularly alarming because prolonged exposure to elevated blood pressure increases the lifetime risk of cardiovascular morbidity and mortality (Anwar *et al.*, 2026). From a public health perspective, the shift of hypertension toward younger populations signals an urgent need for early detection and prevention strategies within high-risk groups, including university students (Bodnar, 2024).

Globally, recent epidemiological estimates suggest that more than 1.2 billion adults live with hypertension, with a growing proportion identified in younger age categories (Chen *et al.*, 2025). Over the past five years, several population-based studies have reported increasing prevalence of prehypertension and hypertension among individuals aged 18–29 years (Cheon, Bittner and Pink, 2025). In many low- and middle-income countries, rapid urbanization, dietary transitions, and psychosocial stressors have accelerated this trend. In Southeast Asia, the burden of hypertension continues to rise, and national health surveys have documented a gradual increase in elevated blood pressure among young adults (Chung *et al.*, 2025). In Indonesia, recent data indicate that hypertension prevalence remains substantial, and screening programs have identified a notable proportion of university-aged individuals with undiagnosed high blood pressure (Dumont *et al.*, 2025). At the local level, campus health records and small-scale community studies suggest that lifestyle-related risk factors are increasingly common among students, raising concerns about early accumulation of cardiovascular risk (Gometi *et al.*, 2026).

Hypertension in young adults is multifactorial, with complex interactions among biological, behavioural, social, and environmental determinants. Among modifiable behavioral factors, unhealthy dietary patterns, particularly high consumption of energy-dense, high-sodium fast food, have been strongly associated with elevated blood pressure (Hendry *et al.*, 2024). Fast food products are typically rich in sodium, saturated fats, and refined carbohydrates, all of which contribute to endothelial dysfunction, increased vascular resistance, and metabolic disturbances. Concurrently, mental stress has emerged as a critical psychosocial determinant of cardiovascular risk (Ilkay, 2025). University students frequently experience academic pressure, financial constraints, social transitions, and uncertainty about future employment, all of which may contribute to chronic stress (Irfan *et al.*, 2025). Physiologically, chronic psychological stress activates the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, leading to sustained increases in cortisol and catecholamines, which can elevate blood pressure (Johar *et al.*, 2024).

Importantly, behavioral and psychosocial factors do not operate independently. Mental stress may influence dietary behaviors, including increased consumption of fast food as a coping mechanism. Stress-induced eating patterns often favor convenient, palatable, high-calorie foods, thereby indirectly increasing cardiovascular risk. Social determinants, such as urban living environments, easy access to fast-food outlets, sedentary academic routines, and limited physical activity, further compound these risks among students. Thus, early hypertension in university populations may reflect an intersection of stress exposure and unhealthy dietary behaviors within specific socio-environmental contexts.

Although numerous studies have examined dietary risk factors or psychological stress in relation to hypertension separately, findings remain inconsistent when focusing on young adult

populations. Some cross-sectional studies report a significant association between perceived stress and elevated blood pressure. In contrast, others find weak or non-significant relationships after adjusting for confounders such as body mass index and physical activity. Similarly, while high sodium intake and frequent fast food consumption are generally linked to hypertension, evidence among university students is heterogeneous, partly due to differences in measurement tools, dietary assessment methods, and cultural contexts. Moreover, many previous studies have focused on middle-aged populations, limiting the generalizability of findings to younger cohorts.

A critical gap in the literature lies in the limited integration of psychosocial and dietary determinants within a single analytical framework among student populations, particularly in low- and middle-income countries. Few studies have simultaneously examined mental stress and fast-food consumption as joint determinants of early hypertension while accounting for potential confounding factors. Additionally, evidence from Indonesian university settings remains scarce, despite rapid nutritional transitions and increasing academic stress levels in higher education institutions. The lack of localized, context-specific evidence restricts the development of targeted campus-based prevention strategies.

Therefore, this study addresses these gaps by investigating the association between mental stress and fast-food consumption with early hypertension among university students using a cross-sectional design. By integrating psychosocial and behavioral determinants within a single analytical model, this research aims to provide a more comprehensive understanding of modifiable risk factors for elevated blood pressure in young adults.

The novelty of this study lies in three aspects. First, it focuses explicitly on early hypertension in a student population, a group often overlooked in cardiovascular risk research. Second, it simultaneously examines mental stress and fast-food consumption as interrelated determinants rather than isolated variables. Third, it generates empirical evidence from a developing country context, contributing to the global discourse on early cardiovascular risk in transitional societies.

The objective of this study is to analyze the association between mental stress and fast-food consumption with early hypertension among university students. We hypothesize that (1) higher levels of mental stress are significantly associated with increased odds of early hypertension, (2) frequent fast-food consumption is significantly associated with increased odds of early hypertension, and (3) students exposed to both high mental stress and frequent fast-food consumption have a higher likelihood of early hypertension compared to those with lower exposure levels.

RESEARCH METHODOLOGY

Study Design

This study employed a qualitative research design using a phenomenological approach. The phenomenological design was selected to explore and understand students lived experiences regarding mental stress, dietary behaviors, particularly fast-food consumption, and perceptions related to early hypertension. This approach is appropriate for capturing subjective meanings, behavioral motivations, and contextual influences that cannot be adequately explained through quantitative measures. The design enables in-depth exploration of psychosocial and environmental determinants underlying early hypertension risk among university students.

Setting and Participants

The study was conducted at a public university in Indonesia between March and June 2025. The setting was selected for its diverse student population and documented concerns about lifestyle-related health risks among students.

Participants were undergraduate students aged 18–25 years.

Inclusion criteria were:

1. Registered active undergraduate students;
2. Aged between 18 and 25 years;
3. Willing to participate and provide informed consent;
4. Reporting experiences of academic stress or frequent fast-food consumption.

Exclusion criteria were:

1. Students diagnosed with chronic cardiovascular disease before university enrollment;
2. Students are currently undergoing medical treatment for severe psychiatric disorders.
3. Inability to participate in interviews due to communication barriers.

A purposive sampling technique was used to recruit participants who could provide rich, relevant information on the research topic. Maximum variation sampling was applied to ensure diversity in gender, academic year, and faculty background. Recruitment continued until data saturation was achieved, defined as the point at which no new themes emerged from successive interviews. A total of 20 participants were included in the final analysis.

Variables and Measurement

In qualitative research, variables are explored as themes and constructs rather than measured quantitatively. The primary constructs examined in this study included:

1. **Mental Stress:** Students perceived psychological pressure related to academic workload, social expectations, financial concerns, and future career uncertainty.
2. **Fast Food Consumption:** Patterns, frequency, motivations, and contextual factors influencing consumption of commercially prepared high-calorie and high-sodium foods.
3. **Perceived Early Hypertension Risk:** Students' awareness, experiences, and interpretations of elevated blood pressure or related symptoms.

Data were collected using a semi-structured interview guide developed from relevant public health literature and theoretical perspectives on behavioural and psychosocial determinants of health. Three public health experts reviewed the interview guide to ensure content validity. A pilot interview was conducted with two students to refine the clarity and relevance of the questions. Reliability was strengthened through consistent use of the interview guide, audio recording of interviews, and verbatim transcription. Member checking was conducted with selected participants to confirm the accuracy of interpretations. Primary data were obtained directly from participants through in-depth interviews. Field notes were used to complement interview data and capture non-verbal cues and contextual observations.

Data Collection Procedures

Data collection was conducted through face-to-face semi-structured interviews in a private room within the university campus to ensure confidentiality and minimize distractions. Each interview lasted approximately 45–60 minutes. Interviews were conducted in Bahasa Indonesia and audio-recorded with participants' permission. Before each interview, participants received an explanation of the study objectives, procedures, and confidentiality measures. Written informed consent was obtained before participation.

Quality control procedures included:

1. Use of a standardized interview protocol;

- 2. Training of the interviewer to ensure consistency.
- 3. Audio recording and verbatim transcription;
- 4. Triangulation through field notes;
- 5. Peer debriefing among research team members;
- 6. Member checking to enhance credibility.

Data Analysis

Data were analyzed using thematic analysis following Braun and Clarke’s six-step framework: (1) familiarization with data, (2) generation of initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. All interview transcripts were read repeatedly to ensure immersion in the data. Coding was conducted manually and supported by qualitative data analysis software (NVivo version 12). Codes were grouped into categories and subsequently organised into overarching themes reflecting the psychosocial and behavioural determinants of early hypertension.

To enhance trustworthiness, the study applied criteria of credibility, transferability, dependability, and confirmability. Credibility was strengthened through member checking and peer review. Dependability was ensured through audit trails documenting analytic decisions. Confirmability was supported by reflexive journaling to minimize researcher bias. Although qualitative research does not rely on statistical significance testing, rigor was maintained through systematic analytic procedures and transparent documentation.

Ethical Approval

This study received ethical clearance from the Health Research Ethics Committee of University Muhammadiyah Jember, Indonesia (Approval Number: B-585/PT19.2.1/PP/VI/2025). All participants provided written informed consent before data collection. Participants were informed about their right to withdraw at any time without penalty. Confidentiality was ensured by anonymizing transcripts and removing identifying information. Audio recordings and transcripts were securely stored and accessible only to the research team.

RESULT

Data analysis yielded four major themes and 12 subthemes that describe the interrelationships among mental stress, fast food consumption, and perceived early hypertension risk among university students. Data saturation was achieved after the 18th interview; however, two additional interviews were conducted to confirm thematic stability. No new codes or themes emerged in the final interviews, indicating analytic saturation.

Table 1. Thematic Analysis of Students’ Experiences on Mental Stress, Fast Food Consumption, and Early Hypertension Risk

Theme	Key Subthemes	Core Meaning	Public Health Implication
Psychosocial Stress	Academic, financial, emotional	Chronic stress as upstream determinant	Stress management programs
Fast Food Coping	Emotional eating, convenience	Behavioral mediator of risk	Healthy campus food policy
Awareness Gap	Misperception, low screening	Knowledge–behavior gap	Health literacy interventions
Stress–Diet Interaction	Symptoms, behavioral cycle	Integrated risk pathway	Comprehensive prevention strategy

This table presents the major themes and subthemes identified through thematic analysis, highlighting patterns of students' experiences related to psychosocial stress, dietary behaviors, and perceived risk of early hypertension. It also outlines the underlying meanings and corresponding public health implications derived from the data.

Theme 1: Academic and Psychosocial Stress as Persistent Pressure

Participants consistently described academic workload, examinations, deadlines, and future career uncertainty as primary sources of chronic stress.

Subtheme 1.1: Academic Overload and Time Pressure

Students reported tight schedules, overlapping assignments, and limited rest.

"Almost every week there are deadlines. Sometimes I sleep only three or four hours because I'm worried about finishing everything." (Participant 3, female, 21 years)

Subtheme 1.2: Fear of Academic Failure and Future Uncertainty

Concerns about grades and employment prospects intensified psychological distress.

"I feel anxious about my GPA and whether I will get a job after graduation. It keeps me thinking all the time." (Participant 11, male, 22 years)

Subtheme 1.3: Financial and Family Expectations

Several participants reported pressure related to tuition costs and parental expectations.

"My parents work hard to pay for my education. I feel stressed because I don't want to disappoint them." (Participant 7, female, 20 years)

Students frequently described stress as persistent rather than episodic, suggesting prolonged psychological activation.

Theme 2: Fast Food as a Coping Mechanism and Practical Choice

Fast food consumption was not merely a dietary preference but was closely linked to stress management and convenience.

Subtheme 2.1: Stress-Induced Eating

Participants reported increased fast-food consumption during stressful periods.

"When I'm stressed, I just order fried chicken or burgers. It feels comforting, and I don't have to think." (Participant 5, male, 19 years)

Subtheme 2.2: Convenience and Time Constraints

Limited time for meal preparation led students to rely on readily available food options.

"Cooking takes time. Fast food is quick and cheap, especially when I have back-to-back classes." (Participant 14, female, 23 years)

Subtheme 2.3: Social Environment and Peer Influence

Group activities and social gatherings often involved fast food.

"If we hang out, it's usually at a fast-food place. It's affordable, and everyone agrees." (Participant 9, male, 21 years)

Students acknowledged frequent consumption of high-sodium and fried foods, often several times per week.

Theme 3: Limited Awareness of Early Hypertension Risk

Despite reporting stress and unhealthy eating patterns, awareness of early hypertension risk was generally low.

Subtheme 3.1: Perception of Hypertension as an 'Older Adult Disease'

Most participants believed that hypertension affects only older individuals.

“High blood pressure is something my grandparents have. I never thought students could get it.” (Participant 2, female, 18 years)

Subtheme 3.2: Underestimation of Symptoms

Some students reported headaches or fatigue, but did not associate them with blood pressure.

“Sometimes I feel dizzy after staying up late, but I think it’s just a lack of sleep.” (Participant 16, male, 24 years)

Only a few participants had ever checked their blood pressure voluntarily.

Theme 4: Interconnection Between Stress, Diet, and Physical Symptoms

Participants described how stress and dietary habits interacted and contributed to perceived physical discomfort.

Subtheme 4.1: Emotional Exhaustion and Physical Complaints

Students reported headaches, palpitations, and fatigue during high-stress periods.

“When exams come, I feel my heart beating fast and my head throbbing.” (Participant 6, female, 22 years)

Subtheme 4.2: Cycle of Stress and Unhealthy Eating

Stress triggered fast food consumption, which was followed by feelings of guilt or physical discomfort.

“After eating too much fast food, I feel bloated and tired, but when I’m stressed again, I repeat it.” (Participant 12, male, 20 years)

Participants perceived a cyclical relationship between psychological stress and unhealthy dietary behaviors, potentially contributing to early cardiovascular risk.

Thematic redundancy was observed after the 18th interview, with no emergence of new codes related to stress patterns, dietary behaviors, or perceptions of hypertension risk. The final two interviews confirmed the stability of identified themes. Peer debriefing among the research team verified consistency in coding and theme development, supporting analytic credibility. Overall, findings indicate that mental stress and fast-food consumption are closely intertwined within students’ daily experiences and may contribute to early hypertension risk through behavioral and psychosocial pathways.

Table 2. Matrix of Themes, Patterns, and Public Health Interpretation

Major Theme	Subthemes	Pattern Across Participants	Underlying Mechanism	Public Health Interpretation	Strategic Implication
Academic and Psychosocial Stress as Persistent Pressure	Academic overload; Financial uncertainty; Emotional coping difficulties	Reported consistently across gender and academic year; described as chronic rather than episodic	Prolonged activation of the stress response (HPA axis and sympathetic nervous system) leading to physiological arousal	Chronic psychosocial stress constitutes an upstream determinant of early cardiovascular risk among students	Campus-based stress reduction programs and structured mental health services are required
Fast Food Consumption as Stress-Driven	Convenience; Emotional eating;	Increased frequency during examination	Stress-induced eating behavior and high sodium/saturated	Fast food consumption functions as a behavioral	Regulation of campus food environments

Coping Behavior	Environmental accessibility	periods and deadline pressure	fat intake contribute to vascular strain	mediator linking stress to elevated blood pressure risk	and promotion of healthier food alternatives
Limited Preventive Awareness and Behavioral Inertia	Recognition of symptoms; Lack of lifestyle modification; Irregular health monitoring	Students acknowledged risk but demonstrated minimal behavior change	Knowledge–behavior gap influenced by environmental and motivational barriers	Awareness alone is insufficient to prevent early hypertension without structural and behavioral support	Integrative health literacy and behavior-change interventions targeting young adults

The findings reveal a structured causal pathway. Psychosocial stress operates as the primary upstream determinant. Under sustained academic and social pressures, students adopt maladaptive coping strategies, particularly frequent consumption of fast food. This behavior serves as an intermediary mechanism that exacerbates physiological vulnerability to early hypertension. Although some students reported awareness of elevated blood pressure or related symptoms, limited preventive action suggests a persistent knowledge-practice gap. The interaction between psychological stressors and obesogenic campus environments reinforces cardiovascular risk accumulation at a young age. Early hypertension among students, therefore, reflects a multidimensional public health issue shaped by psychosocial strain, behavioral coping patterns, and environmental exposure. These findings underscore the need for comprehensive campus health strategies integrating mental health services, nutritional environment modification, and proactive cardiovascular screening.

The qualitative findings indicate that early hypertension risk among university students emerges from the dynamic interaction between psychosocial stress and maladaptive coping behaviors. Academic overload, financial concerns, and uncertainty about the future generate sustained psychological pressure. This chronic stress response contributes not only to physiological arousal but also to behavioral adaptations, particularly increased consumption of fast food. Fast food intake serves as a coping mechanism that provides temporary emotional relief while simultaneously increasing exposure to high levels of sodium and saturated fat. This behavioral pathway mediates the relationship between stress and elevated blood pressure risk. Although participants demonstrated partial awareness of hypertension symptoms and risk, preventive actions were minimal, reflecting a persistent knowledge-behavior gap. Overall, the synthesis highlights a sequential pathway: psychosocial stress as the upstream determinant, stress-induced fast-food consumption as the intermediary mechanism, and early hypertension vulnerability as the downstream outcome. These findings underscore that early hypertension among students is not solely a biomedical condition but a multidimensional public health issue requiring integrated mental health, nutritional, and preventive strategies at the campus level.

DISCUSSION

This study explored the interplay between mental stress, fast food consumption, and early hypertension risk among university students. The findings indicate that psychosocial stress, driven primarily by academic workload, financial concerns, and uncertainty about future employment, constitutes a persistent, chronic pressure in students' daily lives. Fast food consumption emerged as a common coping strategy, particularly during periods of heightened

academic demand. Although several participants reported awareness of elevated blood pressure or related symptoms, preventive behavior and sustained lifestyle modification were limited (Yuan *et al.*, 2026). The thematic synthesis suggests a sequential pathway in which chronic stress operates as an upstream determinant, fast food consumption functions as a behavioral mediator, and early hypertension vulnerability manifests as a downstream health consequence (Khan and Moreira, 2025).

The findings can be interpreted through the lens of the Social Determinants of Health framework and stress-coping theory. From a social determinants perspective, students are embedded in structural environments characterized by academic pressure, urban food environments, and limited time resources (Minari and Pisani, 2025). These contextual factors shape health behaviors and influence cardiovascular risk. Stress-coping theory further explains that individuals experiencing chronic stress often adopt emotion-focused coping strategies, such as consuming palatable, energy-dense foods, to achieve temporary psychological relief (Mukherjee *et al.*, 2024). Physiologically, prolonged activation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system may elevate blood pressure through sustained cortisol and catecholamine release (Nyaaba *et al.*, 2026). Thus, early hypertension in this population reflects the interaction between psychosocial strain and maladaptive coping behavior within specific environmental contexts (Porrás-Pérez *et al.*, 2025).

The present findings are consistent with global research demonstrating an increasing prevalence of elevated blood pressure among young adults (Radtke, Steinberg and Scherr, 2024). Studies conducted in North America and Europe have reported associations between perceived stress and systolic blood pressure, particularly among university students facing academic strain (Roddick *et al.*, 2025). Similarly, research in several Asian countries has identified frequent fast food consumption as a contributor to high sodium intake and increased hypertension risk (YANG *et al.*, 2025). Regional studies in Southeast Asia have highlighted the rapid nutritional transition toward ultra-processed foods among urban youth populations (Samuel *et al.*, 2025). Our findings align with this broader evidence, reinforcing the notion that psychosocial stress and dietary behavior are interconnected determinants of early cardiovascular risk.

While the convergence of findings supports the existing literature linking stress and unhealthy dietary patterns to hypertension risk, some divergence has been observed in previous quantitative studies, which reported weak or non-significant associations after adjustment for body mass index and physical activity (Suprpto *et al.*, 2025). The present qualitative approach may explain this discrepancy (Vahid *et al.*, 2026). Unlike quantitative surveys that isolate variables, our findings demonstrate how stress and fast food consumption are dynamically intertwined in daily lived experiences (Suprpto *et al.*, 2024). The behavioral pathway identified in this study suggests that stress does not act in isolation but indirectly influences hypertension risk through coping behaviors. This contextualized understanding may clarify why statistical associations sometimes appear inconsistent across studies.

The findings have several implications for public health policy and campus health management. First, early hypertension screening should be integrated into routine student health services to identify elevated blood pressure at an early stage (Umer *et al.*, 2025). Second, universities should implement structured stress-management programs, including counselling services, mindfulness training, and workload management strategies. Third, campus food environments should be modified to promote healthier, affordable alternatives and limit excessive availability of high-sodium fast food options. A comprehensive approach that addresses both

psychosocial determinants and environmental influences is necessary to prevent early accumulation of cardiovascular risk among students.

Strengths and Limitations

This study has several strengths. The qualitative design enabled in-depth exploration of students lived experiences, providing contextual insights often overlooked in quantitative studies. The use of thematic analysis with systematic coding procedures enhanced analytic rigor, and data saturation strengthened credibility. Including participants from diverse academic backgrounds improved transferability within similar university contexts. However, certain limitations should be acknowledged. The study was conducted within a single university setting, which may limit generalizability to other institutions or cultural contexts. Self-reported perceptions of stress and dietary behavior may be subject to recall or social desirability bias. Additionally, as a qualitative study, causal relationships cannot be established. Future research combining qualitative insights with longitudinal quantitative designs may provide stronger evidence of causal pathways.

CONCLUSION

This study aimed to explore the relationship between mental stress, fast food consumption, and early hypertension risk among university students. The findings demonstrate that chronic psychosocial stress, primarily driven by academic and financial pressures, contributes to maladaptive coping behaviors, particularly frequent fast-food consumption. This behavioral pattern, characterized by high sodium and saturated fat intake, increases vulnerability to early hypertension. Although students demonstrated partial awareness of elevated blood pressure risk, preventive behaviours remained limited, indicating a persistent gap between knowledge and action.

These findings confirm that early hypertension among students is shaped by the interaction between psychosocial determinants and unhealthy dietary environments rather than by isolated biomedical factors. Therefore, integrated campus-based interventions are essential. Universities should implement routine blood pressure screening, structured stress management programs, and policies that promote healthier food environments. At the policy level, strengthening preventive strategies targeting young adults is critical to reducing long-term cardiovascular risk and supporting broader non-communicable disease prevention efforts.

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This research received no external funding and was conducted independently by the author.

Conflict of Interest

The author declares no conflict of interest related to this study.

Authors' Contributions

Cipto Susilo conceptualized the study, designed the research methodology, coordinated the data collection process, performed data analysis, and drafted the initial manuscript. Ari Setyawati contributed to the study design, supervised the research implementation, and provided critical revisions to improve the scientific content of the manuscript. Indrawati Aris Tyarini assisted in data interpretation, contributed to literature review development, and participated in manuscript editing. Matilda Martha Paseno supported data collection and management, assisted with statistical verification, and contributed to the final review and approval of the manuscript.

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