# Factors Associated with Stroke Incidence at Advent Hospital Bandar Lampung

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## ABSTRACT

**Introduction:** Stroke is a serious neurovascular condition caused by impaired cerebral blood flow, resulting in neurological deficits and potentially permanent disability or death. Modifiable risk factors such as body mass index (BMI), diabetes mellitus, and hypertension have been shown to significantly influence stroke incidence.

**Objective:** This study aimed to analyze the relationship between BMI, blood glucose levels, and hypertension with stroke incidence at Adventist Hospital Bandar Lampung.

**Method**: A quantitative, cross-sectional study design was used, involving stroke patients selected through simple random sampling. Data were collected through medical record review and analyzed using the Chi-square test with a predetermined level of significance.

**Results:** The findings revealed significant associations between BMI, diabetes status, and hypertension with stroke type. Individuals with normal BMI were more likely to experience non-hemorrhagic stroke, while those with abnormal BMI had a higher tendency toward hemorrhagic stroke. Patients with elevated blood glucose levels were more frequently diagnosed with non-hemorrhagic stroke. Similarly, individuals with hypertension showed a stronger tendency toward non-hemorrhagic stroke compared to those with normal blood pressure.

**Conclusion:** BMI, blood glucose levels, and hypertension are significantly related to the type and occurrence of stroke. These results underline the importance of maintaining a healthy lifestyle by regulating weight, managing blood sugar, and controlling blood pressure. Strengthening health education and preventive strategies through hospital-based media can help reduce stroke risk. Further research is encouraged to explore other contributing factors and to enhance clinical practices in stroke prevention and management.

**Keywords:** body mass index, diabetes mellitus, hypertension, stroke

**Introduction**

Stroke is a major neurovascular disorder characterized by the sudden onset of clinical symptoms due to focal or global neurological deficits, which may lead to long-term disability or death (Azzubaidi et al., 2024 in Kurniati et al., 2024). It occurs when the cerebral blood supply is disrupted—either by an obstruction (ischemic stroke) or by the rupture of a blood vessel (hemorrhagic stroke). This disruption deprives brain tissue of oxygen and essential nutrients, resulting in cellular damage and loss of neurological function. Clinically, stroke is classified into two primary types: hemorrhagic and non-hemorrhagic (ischemic). Common manifestations include sudden speech difficulties, facial asymmetry, unilateral numbness or paralysis, blurred vision, severe headaches, and impaired motor coordination. If not treated promptly, stroke may result in serious complications such as cerebral edema, deep vein thrombosis, hydrocephalus, dysphagia, locked-in syndrome, coma, or death (Ariyanto et al., 2021).

Several risk factors have been identified as contributors to stroke, with hypertension being the most prominent. Additional factors include age, gender, diabetes mellitus, smoking, obesity—often assessed via body mass index (BMI)—cardiovascular disease, genetic predisposition, drug abuse, and psychological stress (World Health Organization, 2022). BMI, defined as weight in kilograms divided by the square of height in meters ($kg/m^2$), is a widely used metric to categorize levels of body fat and obesity (Ministry of Health, 2020; Irianto, 2017 in Haryani, 2024). Obesity significantly contributes to stroke pathogenesis due to the chronic pro-inflammatory state induced by excess adipose tissue, which promotes atherosclerosis and increases cerebrovascular risk. From a pathophysiological perspective, chronic hypertension leads to vascular remodeling, including atherosclerosis, arterial narrowing, rupture, or occlusion, all of which impair cerebral perfusion and heighten stroke risk (Wade, 2021). Likewise, poorly controlled diabetes causes endothelial dysfunction and accelerates atherosclerotic plaque formation, further compounding the risk of stroke and peripheral artery disease (Grotta et al., 2022; Horeunnisa et al., 2023).

Preliminary data from Advent Hospital in Bandar Lampung reported 124 stroke cases between September and October 2024. A pre-survey involving 10 patients revealed an even distribution between hemorrhagic and non-hemorrhagic stroke types. Of these patients, 70% had a body weight ranging from 71 to 80 kg, and 60% had a height between 155 and 160 cm. Two individuals were categorized as obese, with BMI values of 33.3 and 32.35. Furthermore, 60% had a history of hypertension, and 80% had diabetes mellitus.

Based on these observations, the researchers hypothesize that anthropometric factors—particularly body weight and BMI—are significantly associated with stroke incidence. Therefore, this study aims to examine the relationship between these risk factors and stroke occurrence at Advent Hospital Bandar Lampung in 2025, with the ultimate goal of informing early detection and prevention strategies.

**Objective**

This study aimed to analyze the relationship between BMI, blood glucose levels, and hypertension with stroke incidence at Adventist Hospital Bandar Lampung.

**Method**

This study employed a quantitative research approach with a cross-sectional design to examine the relationship between anthropometric factors and stroke incidence. The study population consisted of 124 stroke patients treated at Advent Hospital Bandar Lampung. The sample size was determined using the Slovin formula, resulting in a total of 95 respondents. Participants were selected using a simple random sampling technique to ensure representativeness and minimize selection bias.

**Result**

This study included 95 respondents diagnosed with either hemorrhagic or non-hemorrhagic stroke at Adventist Hospital Bandar Lampung. The relationship between body mass index (BMI), diabetes status, and hypertension with stroke incidence was analyzed using the Chi-square test, with a significance level set at $p < 0.05$.

Table 1. Relationship Between BMI, Diabetes, Hypertension, and Stroke Incidence at Adventist Hospital Bandar Lampung

| Risk Factor | Category | Hemorrhagic Stroke | Non-Hemorrhagic Stroke | Total | $p$-value | OR |
|---|---|---|---|---|---|---|
| **Body Mass Index** | Less | 12 (75.0%) | 4 (25.0%) | 16 (100%) | 0.003 | – |
| | Normal | 4 (16.0%) | 21 (84.0%) | 25 (100%) | | |
| | Overweight | 14 (42.4%) | 19 (57.6%) | 33 (100%) | | |
| | Obese | 8 (38.1%) | 13 (61.9%) | 21 (100%) | | |
| **Diabetes Status** | Hypoglycemia | 33 (55.9%) | 26 (44.1%) | 59 (100%) | 0.000 | 7.869 |
| | Hyperglycemia | 5 (13.9%) | 31 (86.1%) | 36 (100%) | | |
| **Hypertension Status** | Normal | 22 (71.0%) | 9 (29.0%) | 31 (100%) | 0.000 | 7.333 |
| | Hypertension | 16 (25.0%) | 48 (75.0%) | 64 (100%) | | |

Based on the analysis, the majority of respondents with a normal BMI experienced non-hemorrhagic stroke, totaling 21 individuals (84.0%). The Chi-square test showed a statistically significant relationship between BMI and stroke incidence with a $p$-value of 0.003.

In terms of diabetes status, most respondents diagnosed with non-hemorrhagic stroke had hyperglycemia (86.1%), while those with hypoglycemia were more likely to experience hemorrhagic stroke (55.9%). The statistical test revealed a significant association ($p = 0.000$), with an odds ratio (OR) of 7.869. This indicates that respondents with hyperglycemia had a 7.869 times greater likelihood of experiencing non-hemorrhagic stroke compared to those with hypoglycemia.

Regarding hypertension, 75% of hypertensive respondents experienced non-hemorrhagic stroke, whereas 71% of those with normal blood pressure had hemorrhagic stroke. The association was statistically significant ($p$ = 0.000), with an odds ratio of 7.333, indicating that hypertensive individuals were 7.333 times more likely to suffer from non-hemorrhagic stroke compared to those with normal blood pressure.

**Discussion**

Body mass index (BMI) plays a crucial role in the pathophysiology of stroke, as it is closely linked to body weight and fat distribution. Excess adipose tissue, particularly in the abdominal region, promotes the development of atherosclerosis—a condition characterized by the accumulation of fatty deposits within arterial walls. This condition is associated with metabolic disorders such as diabetes mellitus, hypertension, and hyperlipidemia. According to Kurniati et al. (2024), fat transported through the bloodstream can accumulate and form emboli, which may obstruct blood flow and trigger vascular events, including stroke. Consequently, maintaining a healthy body weight is essential for reducing stroke risk.

Hutagalung (2021) emphasizes that achieving and maintaining an ideal body weight not only reduces the risk of stroke but also helps prevent other serious health conditions, including cardiovascular disease, type 2 diabetes, gallstones, respiratory disorders, and certain types of cancer. Conversely, being underweight can compromise the immune system, lead to fatigue, and increase the risk of bone injuries. Although BMI is a widely used indicator of body fat based on the ratio of weight to height, it does not account for important factors such as age, gender, muscle mass, or fat distribution. Therefore, while BMI serves as a useful screening tool, its limitations must be acknowledged.

Based on these findings, the researchers assume that increased body weight significantly elevates the risk of stroke. Although maintaining a balance between body weight and height may be challenging, it remains a critical preventive measure. Simple lifestyle changes—such as engaging in light physical activity, reducing dietary intake of carbohydrates and fats, and maintaining an overall active lifestyle—are effective strategies. Preventive efforts should be tailored to individual capacities, especially considering varying personal resources such as time and energy.

In addition to BMI, elevated blood glucose levels also significantly contribute to stroke risk. Diabetes mellitus, characterized by chronic hyperglycemia, damages the endothelial lining of both small and large blood vessels. As noted by Grotta et al. (2022), this vascular damage accelerates the formation of atherosclerotic plaques, which in turn impairs blood flow and oxygen delivery to vital organs, particularly the brain. This mechanism underlies the increased incidence of ischemic stroke and peripheral artery disease among individuals with diabetes.

Given the high consumption of sugar and carbohydrate-rich foods—such as rice—in the general population, careful management of dietary intake is essential. While carbohydrates and sugars are necessary macronutrients, maintaining blood glucose levels within normal limits is vital for stroke prevention. Therefore, public health strategies should encourage awareness of healthy eating practices and promote regular physical activity. As with weight management, diabetes prevention efforts must be adapted to each individual's lifestyle and available resources to ensure sustainability and effectiveness.

**Conclusion**

This study found a significant relationship between body mass index (BMI), blood glucose levels, and hypertension with the incidence of stroke at the Bandar Lampung Adventist Hospital. Individuals with abnormal BMI, hyperglycemia, and hypertension were more likely to experience stroke, particularly of the hemorrhagic type. These findings highlight the importance of maintaining a healthy lifestyle through the regulation of body weight, blood sugar, and blood pressure as key strategies for stroke prevention. Health education targeting patients' families and the general public should be enhanced through hospital media channels. Future research is recommended to explore additional stroke risk factors and interventions to support ongoing advancements in nursing and clinical practice.

### Authors' contribution
Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

### Conflict of interest
The researchers stated that there is no conflict of interest related to the implementation and publication of the results of this research. The entire research process, from planning, data collection, analysis, to report preparation, was carried out independently without any influence or pressure from any third party. A commitment to research ethics is upheld throughout the research process, ensuring transparency, accuracy and honesty in reporting results. Respondents' participation was voluntary with informed consent, and their confidentiality and privacy were maintained in accordance with applicable research ethics standards. With this statement, researchers hope that the research results can be trusted and used as a valid reference for the development of science and health practices related to ethnomedicine and reproductive health.

### Ethical consideration
Not applicable.

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